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Simona Claudia Winkler

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For my mother who died tragically young and before her time…

Für meine viel zu früh verstorbene Mutter…

"We live in dangerous times: man has learnt to cotrol nature before he has learnt to control himself."

- ALBERT SCHWEITZER, 1875 – 1965, German physician, Protestant theologian, philosopher, musician, Peace Nobel Prize Laureate 1952

"Wir leben in einem gefährlichen Zeitalter: Der Mensch beherrscht die Natur, bevor er gelernt hat, sich selbst zu beherrschen."

- ALBERT SCHWEITZER, 1875 – 1965, deutscher Arzt, evangelischer Theologe, Philosoph, Musiker, Friedensnobelpreisträger 1952

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CONTENTS

T H E O R Y

FIGURES

TABLES

ABBREVIATIONS

ADI	Acceptable Daily Intake
AGES	Austrian Agency for Health and Food Safety (Österreichische Agentur für Gesundheit und Ernährungssicherheit GesmbH)
AMA	Agrarmarkt Austria Marketing GesmbH
APSD	Official Austrian Plant Protection Service (Österreichischer) Amtlicher Pflanzenschutzdienst
AR	see (M)AR
BAES	(Austrian) Federal Office for Food Safety (Österreichisches Bundesamt für Ernährungssicherheit)
BCA	Biological Control Agent
BMLFUW	Federal Ministry of Agriculture, Forestry, Environment and Water management Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft)
BOV	Austrian Fruit Growers (Bundesobstbauverband)
BP	Blossom Protect
BSC	Balanced Scorecard
CAC	Command-and-control
CBA	Cost Benefit Analysis
CEC	Commission for Environmental Cooperation
CFCs	Chlorofluorocarbons
CS	Consumer Surplus
CSR	Corporate Social Responsibility
E.a.	Erwinia amylovora (bacteria causing fire blight)
EC	European Community
EEA	European Environment Agency
EEC	European Economic Community
EFSA	European Food Safety Authority
EIONET	European Environment Information and Observation Network
EMAS	European Environmental Management and Auditing Scheme
EPA	Environmental Protection Agency
EPPO	European and Mediterranean Plant Protection Organization
EU	European Union
FAO	United Nation Food and Agriculture Organisation
FB	Fire Blight
FDI	Financial Direct Investment
FERC	U.S. Federal Energy Regulatory Commission
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GDR	German Democratic Republic (former East Germany)
GESG	Federal Austrian Law for Health and Food Safety (Gesundheits- und Ernährungssicherheits-Gesetz)
GesmbH	German for: "Company Ltd."
GHG	Greenhouse Gas
GNP	Gross National Product
IMHO	In My Humble Opinion
INC	Inter-state Negotiation Committee
IP	Integrated Production (Integrierte Produktion)
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control (in theory)
IPPC	International Plant Protection Convention (in case study)
ISPMs	International Standards for Phytosanitary Measures
IT	Information Technology
LKÖ	Austrian Chamber of Agriculture (Landwirtschaftskammer Österreich)
(M)AR	(Multi) Antibiotic Resistant
MEA	Multilateral Environmental Agreements
MS	Member State
NAAEC	North American Agreement on Environmental Cooperation
NAFTA	North American Free Trade Agreement
NGO	Non-Governmental Organisation

NPV	Net Present Value
OECD	Organisation for Economic Co-Operation and Development
ÖEIB	Austrian Full-time Beekeepers Confederation (Österreichischer Erwerbsimkerbund)
ÖIB	Austrian Beekeeper Confederation (Österreichischer Imkerbund)
ÖIZ	Austrian center for beekeeping (Österreichisches Imkereizentrum)
OÖLVB	Upper Austrian Provincial Association for beekeeping (Oberösterreichischer Landesverband für Bienenzucht)
ÖPUL	Austrian Program for environment-appropriate agriculture (Österreichisches Programm für umweltgerechte Landwirtschaft)
ORF	Austrian (Public) Television Broadcaster (Österreichischer Rundfunk)
PHSC	Plant Health Standing Committee
PPR	Pannel on Plant Protection Products and their Residues
PR	Public Relations
PRA	Pest Risk Assessment
rRNA	Ribosomal Ribonucleic Acid
SAR	Systemic Acquired Resistance
SCFCAH	Standing Committee on the Food Chain and Animal Health
SME	Small and Medium sized Enterprises
SPM	Sanitary and Phytosanitary Measures
SPS	Sanitary and Phytosanitary Measures
TEC	Treaty Establishing the European Community 2002
TEC	Trade and Environment Committee (in the respective chapter on the WTO)
TRI	(U.S.) Toxic Release Inventory
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCHE	United Nations Conference on the Human Environment
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
VBNC	Viable But Non-Culturable (bacterial state)
VSL	Value of a Statistical Life
WHO	World Health Organisation
WTO	World Trade Organisation
WTP	Willingness-to-pay

T H E O R Y:

1. Introduction

Governments are in charge of administrating the well-being of a society. In respect to environmental problems it will be shown, that governmental interference is needed. "Wealth" of societies is stated by [Wicke et al 1991] to consist of

- material goods (e.g. the production of a refrigerator at some expense of natural environmental decay by the emissions etc. caused) and
- non-material goods (e.g. better air quality at some expense of renouncement of material consumer goods).[1]

Both categories contribute to the needs of individuals and increase their utility.[2] The welfare of a society as a whole is (following the individualist postulate) the sum of all utilities of the individuals within a society.

Individuals have their preferences at different level of endowments (of material and non-material goods). Governments are in charge to restore the social optimum for all inhabitants of a country between these two conflicting goals of societies[3]

- on the one hand creation of wealth of a certain community by establishing an environment prosperous for economic activities (driven by the individuals the strive for profit-maximization), and
- on the other protecting natural environment from deterioration since it is again a factor for influencing societal wealth in economic (e.g. influencing yields in agriculture) but also private sense (e.g. bike-riding-tour in sound nature). Moreover protecting the environment can involve using capital, labour, etc., which are therefore not available to other purposes.[4]

Pollution per se is being perceived as something bad, but also follows from production of necessities. Hence it can be argued, that pollution imposes both benefits and costs. [Krugman et al 2008] explain that the answer to the social optimal quantity of pollution is located where the marginal cost of pollution (being

[1] [Wicke et al 1991], p. 14
[2] [Brent 1996], p. 51
[3] [Wicke et al 1991], p. 6 et seq.
[4] [Revesz et al 2007], p. 13

"the additional cost imposed on society as a whole by an additional unit of pollution") equals the marginal benefit of pollution.[5]

The fact that environmental protection is a pure public good, leads to insufficient allocation. This makes governmental interference in the market necessary to ensure the allocation of the social optimum (constituting an environmental state, that it will harm the public). Preventing environmental degradation competes with the establishment of an atmosphere wherein businesses can prosper in order to generate enough jobs for inhabitants. Governments are yet again financially dependent on taxes paid. Since most countries create their state-income by levies on income, return and added value, the function of reallocation of course is essential in respect to social equity. At the same time the state of the natural environment impacts on economies (most of all in the agricultural sector): climate change causing extreme weather conditions like heavy snowfalls, storm, acid rain, floods, hail can affect yields e.g. in farming, but also damage goods (cars), affect the electricity-supply, cause delivery problems etc.

The chart of [Munich Re] "presents the economic losses and insured losses, adjusted to present values. The trend curves verify the increase in catastrophe losses since 1950" and serves as verification that human impacts on the environment have a boomerang effect heavily affecting economic losses:

[5] [Krugman et al 2008], p. 471

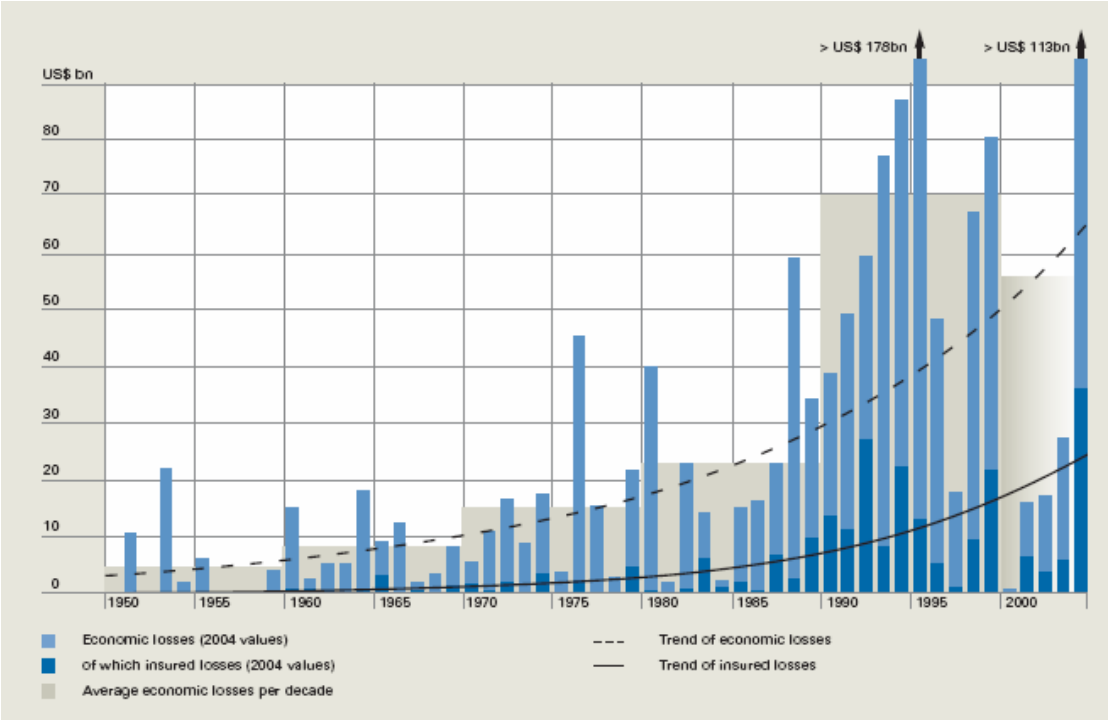

Figure 1: Economic losses and insured losses – Absolute values and long-term trends (2004); Source: [Munich Re 2004], p.15

Every government has their own regulation schemes to overcome and impede certain environmentally challenging behaviours, being formed by the influence of different interest groups. Associations of the economy and environmental protection lobbies are indirect social actors of environmental protection trying to influence decision-making processes of national governments and international organisations (by forming together in umbrella organisations).[6] For the long run it is important to restore to the use of environmental economics measures to put economies on sustainable paths with balanced measures to sustain Pareto optimality.

1.1. Research Questions

In order to reach the Research Objective the following specific research questions have been formed:

- Why are environmental issues causing market failures and is governmental interference the solution to the problem?

[6] [Lang 1989], p. 14

- Which normative and non-normative instruments are there for governments to steer the economy towards the social optimum of environmental protection graded by the respective grade of market-interference of these instruments?
- How does the ruling economic power of business evolve and which possibilities to counteract governmental regulations open up for businesses?

The stress field of governments and businesses shall be analysed by firstly listing the range of options governments have in terms of regulating instruments to achieve environmental protection, by the order of increasing governmental interference. Secondly, anticipated counter pressure opportunities of businesses are plotted, respectively listed by the rising grade of "severity" of their implications. This paper should therefore meet the interest of students or any other persons involved with the questions of how interactions between economy and environmental policy occur.

1.2. Definition of the Terms

1.2.1. Environment

[Wicke et al 1991] states that the "environment" in its widest sense is "the whole of factors designating existence" therefore including the sociological, spatial and biological (ecological) concerns of environment, and the "conditions of air, water, soil, fauna and flora" in the narrowest sense.[7] The definition of the term "environment" is crucial for understanding content and fields of application of environmental law, because it implies specific consequences on the radius of action and definition of norms.

1.2.2. Environmental Issues

According to [Wicke et al 1991] Sources for environmental problems derive from **development factors** (population and economy growth, ongoing tendencies of urbanization, technical changes), **socio-economic factors** (public good-problems, existing externalities, environmental damaging behaviour of individuals) and **system-related factors** (economic system, policy).

[7] [Wicke et al 1991], p. 5

Environmental issues are mainly covered by the following concerns many of them fuelling each other:

- **Climate change** (covering the implications of global warming and dimming; efforts on the mitigation of greenhouse gases that are causing climatic changes, as e.g. through the Kyoto Protocol) and **Ozone depletion**
- **Energy usage concerns** (reduction of societal consumption of fossil fuels; switching to alternative (low-carbon), renewable energy and efficient use of energy, but also threats arising from nuclear power usage, and residual radioactive waste).
- **Conservation** necessities for threatened species extinctions (preservation of species or whole ecosystems from extinction e.g. through whaling; hence, protection of biodiversity and establishment of nature reserves also in order to counteract habitat destruction and fragmentation)
- Air, water, soil and noise **pollution** (e.g. oil spills, acid rain) by the use of toxins (Chlorofluorocarbons, Dioxin, heavy metals, herbicides, pesticides), (toxic) waste reduction and recycling and the exploitation of scarce natural resources (overfishing, logging, mining)
- **Environmental impacts** of huge building projects (e.g. dams), genetically engineered food, overpopulation, urban sprawl and intensive farming (e.g. monocultures, overgrazing).

In the following the term *environmental degradation* shall be used covering all of these negative impacts on environment throughout the paper.

1.2.3. Environmental Policy

Environmental policies try to tackle the problems mentioned above by implementing strategies that are directed towards balancing quantities (of material and immaterial goods) by either

- Direct measures on environmental degrading goods or actions (on pollution itself) reflecting true social costs, or regulating their quantities by law by emission taxes etc., or
- Indirect measures where the source of the environmental degradation is not traceable and only the original activities or goods that yield certain pollution can be targeted (as for example traffic congestions caused by too many cars on the road) mostly regulating quantities by

taxes and production permits on these indirect sources of origin (e.g. by product charges).

Generally it should be aimed at approaching the sources of environmental degradation directly, because it gives incentives to pollution abatement.[8]

Environmental policy making can be considered to be a collective argumentative process to reach sustainability, weighing up social benefits and costs and setting certain priorities, monitoring the condition of nature to draw conclusions from it, and finding arguments for and against different positions.[9]

1.2.4. Environmentalism

Environmentalism is the support of or involvement with the environmental movement by individuals. Nowadays it is a social movement, which seeks to influence the political process by lobbying, education, activism and setting an example in order to protect natural resources and ecosystems.

2. Historical Review and Present

2.1. Development of Multinational Companies and Trade Regulation

After the Second World War circumstances such as rising labour costs in developed countries, increasing consumer demand for novelties, improved transportation possibilities, new communication facilities and the economies of scale (inter alia) triggered the expansion and the building of transnational corporations.[10] By the early 1970s, multinational enterprises already attracted considerable public concern: the argument being that expansion focused primarily on the exploitation of natural and human resources in third-world-countries. These arising ethical issues also included environmental impacts. Due to the fact that multinationals are key players in the world economy (some with yearly revenues in the size of the GNP of whole countries), these companies dispose over a great economic and hence also political power, which can easily lead to reaping benefits for the company and its proprietors. The perception that these companies operate in a vacuum between ineffective national laws and non-

[8] Krugman et al 2008], p. 484
[9] [Bøgelund 2006], p. 79
[10] Information of the subsequent paragraph is mainly based on the information taken from [Fowler 1995]

existent or unenforceable international laws has heightened concerns about the current reach and effectiveness of environmental regulation.[11] [Fowler 1995] stating that "[w]ith the exception of a handful of nation-states, multinationals are alone in possessing the size, technology, and economic reach necessary to influence human affairs on a global basis."

Clearly, multinationals aim for liberalized trade in the global economy. Also the developments in trade regulation are generally perceived to contribute to environmental degradation with the liberalization of international trade by increasing pressure on natural resources[12] and increased flow of goods. According to [Sampson 2002], former Director of the Trade and Environment Division of the WTO, "numerous quantitative studies that have explored the link between growth and environmental degradation have been far from convincing". The explanation he gives is that not free trade itself causes for environmental damage but "inappropriate production and consumption patterns and the failure to implement environment-management programs to deal with the negative implications of growth". As a fact, trade regulations and agreements are the main determining factors for how natural resources are used and major decisions on trade policy are taken on the level of the WTO. The committee of the WTO notes that actions taken to protect the environment and the impact they are having on trade can play an important role in some environmental agreements, particularly when trade is a direct cause of the environmental problems. But it also points out that trade restrictions are not the only actions that can be taken, and they are not necessarily the most effective, because alternatives include helping countries acquire environmentally-friendly technology, giving them financial assistance, providing training, etc. A further consideration brought up by [Sampson 2002] is that removed trade restrictions can result in more environmental conservation activities because of the reduced use of scarce natural resources in better functioning markets through enhanced competition. Undoubtedly this is a possible causal coherence, but unfortunately IMHO seems to be rather wishful thinking than a general fact at present.

[11] [Fowler 1995]
[12] [Nissen 1997]

2.1.1. The Development of the WTO and Environmental Concerns

After the Second World War 15 countries began negotiations trying to correct the legacy of protectionist measures remaining from the early 1930s. 23 founding members eventually signed 1947 a package of trade rules and tariff concessions affecting about one fifth of the world's total trade[13]. The multilateral trading system started to evolve in the 1960s, when a series of multilateral negotiations took place known as "trade rounds", bringing about further development of international trade liberalization, held under GATT's auspices.

In the 1970s and early 1980s, the successful reduction of tariffs were followed by a series of economic recessions driving governments to devise other forms of protection for sectors facing increased foreign competition (establishing bilateral market-sharing arrangements with competitors and embarking on a subsidies race) trying to countervail high rates of unemployment and factory closures. The GATT had been found wanting[14] and the General Agreement from 1940 lagged behind the changes that beginning globalisation had brought about: world trade had become far more complex and important, international investment had expanded and the GATT's institutional structure and its dispute settlement system needed refurbishment and extension to a multilateral system.

From 1986 to 1994 negotiations of the "Uruguay Round" (constituting the most extensive of all eighth GATT rounds) marked a major step in the recognition of the **relationship between trade and the environment** and the need to achieve a balance[15], but failed to clarify the relationship between multilateral environmental agreements (MEAs), therefore not solving the potential conflicts that could arise through possible restrictions of trade (in order to achieve environmental goals). Further decisions on how to incorporate these agreements were "desperately"[16] needed in order to support the environmental objectives of MEA, without endangering indiscrimination. 1994 the Committee on Trade and the Environment (TEC) was established to include and analyse environmental and sustainable development issues.

[13] USD 10 billion, stated by the WTO

[14] It is stated that e.g. in agriculture loopholes in the multilateral system were heavily exploited, and efforts liberalizing agricultural trade had little success.

[15] [Nissen 1997]

[16] [Nissen 1997]

During the Uruguay Round the original GATT articles were reviewed, leading to the establishment of the WTO 1995, being a supranational organisation and constituting a single institutional framework encompassing the GATT with all agreements and arrangements concluded under its auspices (including the results of the Uruguay Round). In the preamble of the Agreement establishing the WTO it is stated that "[members'] relations in the field of trade and economic endeavour should be conducted with a view to raising standards of living [etc.] and expanding […] trade […], while allowing for the optimal use of the world's resources in accordance with the **objective of sustainable development**, seeking both to **protect and preserve the environment** and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development"[17], but there is no specific agreement dealing with the environment.

The WTO and its agreements expanded its competencies (in addition to the trade in goods already regulated under GATT) to trade in services and agriculture and to include the trade of intellectual property. It modernized its dispute settlement system and implemented a monitoring tool called "Trade Policy Review Mechanism" (DSU – Dispute settlement understanding[18]) to regularly review national trade policies and practices of GATT members.

After the Marrakesh Agreement in 1994 commitments were incorporated into the Doha Development Agenda 2001[19]. Further negotiations should clarify the situation of WTO members being party to environmental agreements and the possible fields of conflict of specific trade obligations (and measures taken) arising through the participation in multilateral environmental agreements with WTO rules[20]. The TEC analyses the relationship between trade liberalization (including the Uruguay Round commitments) and the protection of the environment and is especially involved in the exploration of relevant environmental issues and the identification of WTO rules that need to be clarified. An example brought up by the WTO is that the impact of fishery subsidies provided by governments was studied aiming for improvement of WTO rules applying to fishery subsidies. Since subsidies can be environmentally damaging if

[17] [WTO 01]; [WTO 02]
[18] [WTO 03], Article 1 in Annex 2
[19] [WTO 04]
[20] [WTO 05] stating that "[so] far, no action affecting trade and taken under an international environmental agreement has been challenged in the GATT-WTO system." Status: 2007

leading to too many fishermen chasing too few fish, this is of course a very good example.

There are about 200 multilateral environmental agreements outside the WTO dealing with various environmental issues currently in force. According to the WTO approximately 20 of these include provisions that could affect trade by banning trade of certain products, or allowing countries to restrict trade in certain circumstances as e.g. the Basel Convention (trade and transportation of hazardous waste across international borders), etc.

2.1.2. Possible Areas of Conflict of Trade and Environment

Examples of provisions in the WTO agreements dealing with environmental issues[21]:

- Measures serving environmental objective are recognized as legitimate under paragraph (g) of Article XX [i.e. 20] of the GATT 1994.
- GATT Article 14 and Article 20 exempt various policies affecting trade in goods and services for protecting human, animal or plant life or health from normal GATS disciplines under certain conditions (but also provides certain criteria such as non-discrimination)
- Technical Barriers to Trade (i.e. product and industrial standards), and Sanitary and Phytosanitary Measures (animal and plant health and hygiene) explicitly recognize environmental objectives.
- Intellectual property regulations allow governments the refusal of issuing patents that threaten human, animal or plant life or health, or risk serious damage to the environment (TRIPS Article 27).
- Agricultural environmental programs are exempt from cuts in subsidies
- Up to 20% subsidies of firms' costs for adapting to new environmental laws are allowed
- Negotiations on the reduction or elimination of tariff and non-tariff barriers to environmental goods and services.

The Principle of **Extraterritoriality** forbids forcing another MS into the implementation of environmental standards or regulations of domestic law, because possible protectionist abuses (disguised restriction on international trade): imports could be banned merely because of different environmental,

[21] following paragraph is mainly based on information retrieved from [WTO 06]

health and social policies. An example is the "tuna-dolphin"-dispute 1991: the U.S. Marine Mammal Protection Act set dolphin protection standards not only for the domestic fishing fleet, but also for all fishing boats harvesting yellow-fin tuna, banning imports not proving their compliance with U.S. standards. The WTO recommends using the provisions of an international environmental agreement rather than forcing other countries into changing their environmental policies. But also the **"Product" Versus "Process"** Principle tackles the problem that occurs if trade rules permit action to be taken against the method used to produce goods (rather than the quality of the goods themselves) as happened in the mentioned case above. A possible measure would be to apply regulations on the quality or content of a product imported, which can be achieved by eco-labelling requirements. The role of the TEC is to examine whether existing WTO rules stand in the way of eco-labelling policies, and to judge whether labelling describing "the way" a good is produced (rather than the product itself) complies with the rules of the WTO Technical Barriers to Trade Agreement. It is IMHO to be hoped, that the WTO will not interfere in this concern: consumer welfare is also created by spending on the well-being of others (because of the declining marginal utility of income, i.e. explaining donations). "Fair trade" labelled goods are about buying the fact that the coffee-grower has access to medical care and receives a just share of the margin, being issues on "how" the good was produced, but not about the quality of the good itself and a possible case of these considerations of interference with WTO rules. Another principle is the **Non-Discrimination**: WTO Members are free to adopt their own policies aimed at protecting the environment, but respect the rights of other Members. The case "United States Import Prohibition of Certain Shrimp and Shrimp Products" has shown the difficulties occurring in their implementation that has to be overcome by MS agreeing on amendments or waiving the rules (by decisions). The **Transparency**-Principle requires WTO members to provide as much information as possible about adopted environmental policies or actions they may take (if these are judged to have a significant impact on trade) by notifying the WTO, again causing IMHO an administrative burden to many environmental policy instruments. Also in the case of a **domestic prohibition of goods** countries are required to inform on environmental or public health dangers concerning dangerous chemicals. Since international agreements exist (e.g. the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal) the WTO "plays a complementary role" at best. It still is to be judged as dangerous IMHO, that an institution is capable to decide whether a restriction of exports of certain hazardous or toxic products is allowed to be

undertaken, which is not taking over the responsibility for possible impacts on human health (evidence may still be lacking), opposing the implementation of the precautionary principle. Regarding **Intellectual property and services,** the TEC notes that clauses in the agreements on services and intellectual property allow governments to give priority to their domestic environmental policies and it might even be argued that the agreements could help facilitate countries to obtain environmentally-sound technology and products. Also WTO **Dispute settlement procedures** rule to be the only possible forum for settling disputes if they arise due to actions taken by a country participating an environmental agreement outside the WTO and not all parties concerned are members of according environmental agreement.

2.1.3. Future Outlook

Assessing environmental problems of liberalization and making provisions to solve them should be a national task (maybe assisted by NGOs, especially in developing countries, as suggested by [Sampson 2002]) and should not be shifted into the realms of the WTO, which could be considered to only be an additional expansion of its competencies of non-trade matters. Moreover the issue has to be viewed critically in the light that the WTO is not a democratic institution responsible for public concerns but lacking transparent decision processes (also not offering NGO's the chance to participate). According to [Sampson 2002] "*t*he WTO does not want to become an environmental policy-making or enforcement body - nor should it become one." On international level, unfortunately, environmental law has not (yet) managed to install a comparable counterbalance by the implementation of powerful agreements in respect to the WTO, providing mechanisms for settlement of disputes being subject to enforceable compensation. This gap will have to be filled to enable the tackling of environmental issues at international level.

2.2. Development of Environmental Movement

The laissez-faire politics in Europe were characterised by an economic doctrine opposing governmental interference in economic affairs (economic interventionism and taxation) beyond the minimum necessary for the maintenance of security, peace and property rights and resulting in a usually deliberate abstention from direction or interference especially with individual freedom of choice and action for a system of free enterprise to operate according to its own economic laws, believing that private initiative and production are best

to roam freely.[22] This doctrine also embodied free trade and that a state ought not to interfere with protectionist measures (such as tariffs) in order to block or limit trade between countries, forming a purely economical liberal market view, believing that the market would dispense with inefficiencies in a more deliberate and quick manner than any legislating body could. The basic idea is that less government interference in private economic decisions (such as pricing, production, consumption and distribution of goods and services) results in a more efficient economy. Economist Adam Smith posed his invisible hand-theory: since the only way to produce income would be through voluntary exchange, and thus the only way to earn money would be to produce what others wanted, he believed it was the free market guiding people to act in the public interest by following their own self-interest. In the 19th century some European countries followed this doctrine, resulting in free trade treaties being signed. However, at the end of the century these countries found themselves taking up economic protectionism again: after several industrial accidents and other (more insidious) cases of environmental catastrophes, as for example the destruction of the Rhine (by the pharmaceutical industry giant Sandoz), had shown the damage that could be caused by purely profit-driven (environmentally blind) performance. The first treaties concerning international waters in Europe were signed. However, these treaties had not yet an implication on the quality of water per se, but more on laying down founding rules for fishery and shipping usage, especially concerning the bilateral contracts.[23] Environmental protection activities on an international basis began already in the beginning of the 1940s by interstate instances of arbitration. Massive industrial expansion before and after the World Wars also sparked unbridled industrialisation and urbanisation, mining, logging, air pollution, etc. but still only a small number of people tried to raise awareness of environmental destruction. At that time the oceans and rivers were considered unlimited in size, holding fish forever (as it has been the credo in the GDR until the big North See fish depletion and breakdown of fishery). Rachel Carson's book "Silent Spring" published in 1962, not only led to the ban of DDT in American agriculture, but also catalysed environmentalism on an international level raising new public awareness to environmental issues and impacts on human health.

In Europe environmental protection as a topic of international discussion has only come up in 1968, when the Council of Europe released a policy statement on the

[22] The French term "laissez faire", is short for "laissez faire, laissez aller, laissez passer" meaning "let do, let go, let pass" (people as they choose) Source: [Merriam-Webster]

[23] [Lang 1989], p. 14

control of air pollution.[24] European interest grew sharply during the environmental movements of the late 1960s[25] and experienced a great push when the Club of Rome published its famous study "The Limits to Growth" in 1972[26]. Also local TV-shows such as Bernhard Grzimek's "Ein Platz für Tiere" (in Austria and Germany) and a number of events as for example an incident of extreme air pollution in the Ruhr area and oil spills, lead to the building of environmental agencies and pressure groups that were formed during the 70s and 80s.

2.2.1. Creation of International Environmental Institutions

The environment was no longer perceived to be a free good (available in unlimited quantities), but being subject to scarcity and that the different functions how it serves the public ("public consumption good, providing natural resources and receptacle of waste" [27]) are competing with each other (as discussed above). But particularly the issues of global public goods (e.g. air or water quality) are not restricted to certain international (or regional) levels and their institutional powers.[28] Also the existence of international trade law and MNEs clearly necessitate matching organisations. Some international organisations and bodies having been established to protect the environment are stated in the following. Additionally to these international organisations the governments of all developed countries today have government departments or agencies devoted to monitoring and protecting the environment. Furthermore numerous international environmental agreements (made to protect the environment in different ways) exist.

2.2.1.1. UNCHE, UNEP, Brundtland Report, UNCED, Agenda 21

United Nations (UN) specialized agencies and other bodies within the UN system began to devote attention to the issue of climate change, notably the UN Environment Programme (UNEP), which was established to promote environmental practices based on the principles laid down in the Declarations of the UN Conference on the Human Environment (UNCHE), 1972 in Stockholm. Principle 1 of the Stockholm Declaration includes the famous statement of "Man has the fundamental right to freedom, equality, and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he

[24] [Lang 1989], p. 14
[25] [Siebert 1995], p. 3
[26] [Pellikaan et al 2002], p. 3
[27] [Siebert 1995], p. XIII
[28] See [Teegen 2003], p. 271

bears a solemn responsibility to protect and improve the environment for present and future generations."[29] It was then, when many industrialized countries created their own national agencies to address the question of environmental protection. The UNEP is responsible for the development of the international environmental law addressing issues such as the loss of bio-diversity, climate change or desertification etc.[30]. 1983, the UN General Assembly created the UN World Commission on Environment and Development, with Dr. Brundtland as chairperson, who in the 1987 Brundtland Report first coined the term **"sustainable development"** being "[m]eeting the needs of the present generation without compromising the ability of future generations to meet their needs […]"[31]. The United Nations Conference on Environment and Development (UNCED) was held 1992 in Rio de Janeiro producing the Rio Declaration on Environment and Development laying down principles linking economic development to environmental protection in order to create sustainability. The declaration required global partnership involving governments, people and key sectors of society. In addition to the Rio Declaration, the governments attending UNCED also agreed an international action plan called **Agenda 21,** laying down foundations for the promotion of sustainable development in terms of social, economic and environmental progress.[32]

2.2.1.2. Intergovernmental Panel on Climate Change (IPCC)

In October 1988 the World Meteorological Organisation (WMO) and the UNEP established the Intergovernmental Panel on Climate Change (IPCC) in Toronto. The UN-general assembly named the problem of the climate change for the first time. In 1990 the first IPCC report was published and the UN-general assembly entered into negotiations on United Nations Framework Convention on Climate Change (UNFCCC) and arranged the Inter-state Negotiation Committee (INC).

2.2.1.3. Commission for Environmental Cooperation (CEC)

The CEC is an international organisation created by Canada, Mexico and the U.S. under the North American Agreement on Environmental Cooperation (NAAEC) and was established to address regional environmental concerns, to help prevent potential trade and environmental conflicts, and to promote the effective

[29] [UNCHE 1972], Principle 1
[30] [WRI]
[31] [UN]
[32] [UN Global Compact 02]

enforcement of environmental law. The Agreement complements the environmental provisions of the North American Free Trade Agreement (NAFTA).

2.2.1.4. European Environment Agency (EEA)

The agency of the European Union is an independent body established by EEC Regulation 1210/1990 (on the establishment of the European Environment Agency and the European environment information and observation network) and became operational in 1994. In cooperation with the European Environment Information and Observation Network (EIONET), it shall gather and disseminate comparable environmental data and is therefore devoted to establishing a monitoring network and to protect and improve the environment in accordance with the provisions of the Treaty and Community environment action programs, with a view to establishing sustainable development within the Community. Its role is purely advisory but tries to accelerate the adoption of new measures and assesses the impact of decisions already adopted. Its tasks are set to provide comparable information for enhanced measurability at evaluating the implementation of the measures and to ensure that the public is properly informed on the state of the environment.[33]

2.2.1.5. International NGOs and "Soft Law"

International "soft law" is a category of norms, which lacks the compulsory character of traditional law systems, but is respected by the political consensus of nations and therefore has certain expectations concerning its implementation. This soft-law is mostly created by international organisations of governmental experts under many different terms/names: declarations, principles, guidelines, etc. However, nations having voted for adoption can only be expected to behave in accordance to the determined principles based on the principle of equity and good faith, because there is no central enforcement authority enforcing these legal systems. These agreements, therefore, depend to a very high degree on the good-will of nations and their governments.

But international public goods (global warming concerns, clean air) offer nations to act as free riders[34], just as economic actors do (initially causing the market failure because of high transaction costs involved with public goods): [Teegen 2003] argues that national governments will rather be driven by their perceptions

[33] [EU 08]
[34] See [Siebert 1995], p. 209

of their specific nation's interests[35]. [Andersson 1991] e.g. argues that "governments may respond to political pressure rather than maximize social welfare" stating that "[b]ecause pollution tends to hurt large unorganised groups, future generations, and those who are uninformed, there is likely to be a 'government failure' resulting in too little protection of the environment." Moreover, the problem is that government failure of one country can affect the level of environmental protection of others. Anderson's findings suggest that "government failure is a major cause of environmental mismanagement" therefore even calling for an international institution to compensate for these failures.[36]

Due to the supranational venue of global exchanges, national governments are unable to respond to these problems[37]. While markets knowingly fail to account for the externalities, the set-up of the current institutional structures also lead to institutional failure because of high transaction costs associated with the Pareto-allocation of public goods.

Being a consequence of the lack of formal international institutions [Teegen 2003] addresses international NGOs to be "third sector" entities bridging the gap of public and private interests on a global scale: these informal institutions are contributing significant change of the context "within which governments and MNEs interact".[38]

Environmental policy making, considered to be a collective argumentative process weighing up social benefits and costs, setting certain priorities, monitoring (of facts), drawing conclusions, finding arguments for and against different positions has to be influenced by the supranational paradigm of environmental concerns (enabling the view over the rim of the national tea-cup). On this subject [Bøgelund 2007] e.g. states that "key to this process is to make sure that diverse groups of actors are engaged in the assessment process, particularly those voices that are commonly unheard have a place at the table"[39], which are most likely to associate via NGOs, representing bundled public interests.

Environmental NGOs are private organisations involved in lobbying, advocacy, or conservation efforts and include international organisations (i.e. Bird Life

[35] [Teegen 2003], p. 271
[36] [Andersson 1991]
[37] [Teegen 2003], p. 271
[38] [Teegen 2003], p. 271 et seq.
[39] [Bøgelund 2006], p. 79

International)[40] and national organisations in many countries (i.e. the "Transitforum Austria Tyrol"). Their core duties are the supervision of action of environmentally damaging companies, not only regarding the surveillance of the actual impact but also on their behaviour transcending future goals, and watch the lobbying on the European level closely. Through the (monetary or active) support of their members and possibility of building alliances they use their bargaining power to pursue their goals.

But whereas regulated industry groups have a very high level of homogeneity of their wills and overcoming the free rider problem by obligatory membership fees, this is different to the aggregation of environmental interests: on a national and international level these become more heterogenic regarding the preferences of the individuals which priorities to set in environmental policy, how to tackle these and moreover struggle with the free rider effect. The crucial point is whether the economies of scale of joint operation outweigh these problems. [Revesz et al 2007] suggest another important issue namely that the "large number of citizen breathers[41], each with a relatively small stake in the outcome of a particular standard-setting proceeding, will be overwhelmed in the political process by concentrated industrial interests with a large stake in the outcome."[42]

NGOs are found to play a role in scientific boundary-work and the construction of expertise and the distribution of knowledge in a society by [Eden et al 2006] and [Hammar] states that "environmental institutions are one efficient means to loosen informational and political constraints in environmental policy, and, hence, that investment in environmental institutions is justified."

As nowadays the environmental discussion is held on a wide base and the protection of air, water, soil and noise abatement, waste prevention and disposal, energy saving and conservation are becoming a serious issue of public concern environmental institutions are (in the absence of a international institution) found to shape environmental awareness that can influence governmental reaction.

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[40] just to name a few more: The Center for International Environmental Law, Earth Charter Organization, Environmental Investigation Agency, Environmental Law Association Worldwide, EthicalNetwork.org (Global Online community of environmentalists), Foundation for Environmental Education, Friends of the Earth, Green Cross International, Greenpeace, iNSnet, The Nature Conservancy, World Business Council for Sustainable Development, Worldwatch Institute, World Wildlife Fund, etc.

[41] In the example of clean air regulation

[42] [Revesz et al 2007], p. 61

2.2.2. General Conditions for Environmental Movements

Tilly[43] examined the development of environmental movement in the long run in Great Britain and gathered that the "sit-in" as a form of violent-free sitting-protest-action had been used earlier but in the 1960s developed to be a standard protest form. [44] His Framing-theorem[45] tries to take in many dimensions to explain under which conditions environmental groups build and how mobilization of people to fight for environmental improvement can be successful. Since the aim of social movements will always be the broadcasting of scandals and failures in order to overcome this lack, the problem itself, which is dealt with, takes an important role. Every social movement is triggered by the lack of something and by the hope, that this 'need' will be met in future, because authorities respond to the mismanagement. The response of the public to a topic is substantial. Influencing factors of success are:

1) Freedom of the press: only in a system of free press (independent from government) decisions on what shall be printed will be unbiased.

2) Social interest potential: Medias quote stories that interest. Logically seen, the larger the group of potentially interested people, the more resources the media can afford to invest in these topics.

3) The effect on people: issues that affect people do not necessarily interest them. Since natural ecosystems surround us everywhere, there is a good chance that people find themselves affected, but in our modern world of supermarkets, cars, electronics and air-conditioned offices, many people are no longer "attached" to their relationship with nature.

4) Personal ambition/ motivation: people must seek to solve ecological problems, focusing on the natural surroundings and must in any case care for the state of their natural surroundings, and see the direct link to their own level of well-being.[46]. This also requires a certain level of education and the ability to see through the consequences of their individual actions.

It ought to be mentioned at this point that the Coasian Theorem proposes a mechanism by which potential beneficiaries of a public good band together and

[43] In [Roose 2003]: Tilly, Charles 1978: From Mobilization to Revolution, New York u.a.: McGraw-Hill Publishing Company.
[44] [Roose 2003], p. 52
[45] [Roose 2003], p. 47
[46] [Roose 2003], p. 48-51

pool their resources based on their willingness to contribute to the creation of a public good. Coase argued that if the transaction costs between potential beneficiaries of a public good are sufficiently low, and it is therefore easy for beneficiaries to find each other and pool their money, then an adequate level of production for the public good could occur, even under competitive free market conditions. At the time when Coase developed this theorem in the 1960s he might not have anticipated the impact of the internet on the possibility to band together, which is now available for institutions like WWF, Greenpeace, etc.

2.2.3. The Role of Law for Environmental Protection

As shown in above sections, economic power has over time developed and enhanced its legal mechanisms to enforce its interest. Environmental law had to grow to protect nature respectively.

Bearing in mind the market failures already discussed, environmental protection laws play an important role as a counterbalance to organised interests of economical power.[47] To overcome human tendencies to maximize only their present individual profit, environmental law protects the environment for future generations, not yet having a voice to declare their interests and no lobby to defend their rights. Environmental politics, environmental law and environmental aid therefore need open public discussion to bundle and assert diffuse interests of the environment in contrast to the organized interests of economy.

[Mercuro et al 1994] conclude that alterations in (environmental) law have "direct impact upon economic performance including environmental quality" and offer following line of reasoning: changes in law or working rules → lead to changes in the incentive structures → lead to changes in institutional behaviour → lead to changes in economic performance → lead to changes in natural resources and environmental quality.[48]

Subject matter of environmental law is to be understood as "environmental protection law" which is suggested by [Epiney 2005][49] to be a more precise term. Further she argues that the open formulation of Art. 174 TEC seems to indicate a rather wide (maybe too unclear) environmental understanding which is of particular importance, because the definition of the term "environment" must be

[47] [Krämer 2002], p. 3-25
[48] [Mercuro et al 1994], p. 84
[49] [Epiney 2005], p. 3 et seq.

determined in a way, which enables realization of the laid down aims of the framework of common environmental politics. But interestingly the judiciary of the Court of Justice of the European Communities fails to deliver a definition of the term 'environment' and of the term 'environmental protection', which it refers to in its decisions.[50] [Krämer 2002] states that in spite of all the guidelines and regulations, programs and plans, ceremonial statements, charters and conventions, the condition of the environment, is worsening. According to [Krämer 2002] the European Court is the least of all to blame, because on the whole the interpretation of rules for the protection of the environment is environmentally friendly and innovatively reinforced and environmental protection is a European Interest, but there is no group strong enough to conserve theses interests and assert them.[51]

Tackling environmental problems is made more complicated by the increasing technical aspect not only of understanding the causes of numerous means of environmental pollution but also of approaching their effective avoidance or reduction, which again depend on an extremely high degree of developments in technology and technical engineering.

Constitutional law cannot interfere to deal with technicalities, but it constitutes a framework paving the way for the incorporation of effective environmental protection law into "simple legislation". TEC regulations include guidelines and principles for the development of the Common Environmental Law, and can be seen to define the general aim and scope of the material environmental law of MS.

Both the Community and the MS are "responsible" for the protection of the environment, therefore competent. The Community's and the MS' legal system exist in parallel, with Community law being independent of individual state law, constituting a self-contained and developing legal system.[52]

2.3. Birth of Environmental Legislation in Europe

At its founding the EU had no environmental policy or laws[53] and only began to address environmental concerns from 1968[54] on. Since then Common

[50] As per 2005, Source: [Epiney 2005], p. 4
[51] [Krämer 2002], p. 3 et seq.
[52] [Krämer 2002], p. 26 et seq.
[53] [Jordan 1999]
[54] [Lang 1989], p. 14

Environmental Law has increased the development of environmental protection by growing an infrastructure for conservation and the enhancement of importance in the agendas not only on the level of the European Community, but also of the member states (where pre-existing environmental policies have undergone a progressive change through their involvement in EU environmental policymaking).[55]

According to [Krämer 2002] awareness of environmental problems, the existence of only one coherent environment and the need to restore and improve its quality has reached the member states of the European Union. Further it is stated that "practically all member states of the European Union give room to a minimum of 50% [and higher] of common environmental law in their entire national environmental law", also claiming that "a common conviction exists believing in the importance to work out, to ratify, to put into force and to develop common law for the care of environment."[56]

The treaties (constituting "primary legislation" comparable to constitutional law at national level) "lay down the fundamental features of the Union, in particular the responsibilities of the various actors in the decision-making process, the legislative procedures, under the Community system and the powers conferred on them".[57]

When the Treaty establishing the European Economic Community (EEC)[58] was amended in 1987, the EEC started taking up tasks of environmental protection measures, along with increased responsibility in social and regional policies, since it was no longer a purely economic community (renamed by the Maastricht treaty to "European Community"). In 1993 the Community decided to aim for a high (however not the highest-possible!) protection level (Art.174 Abs. 2) based on the precautionary principle and preventive actions (polluter-pays-principle). Since 1997 the principle of sustainable development is one of the EC's main objectives and stipulates that environmental protection requirements must be integrated into the definition and implementation of other areas of Community policies.[59]

Simultaneously this evolution can be observed in secondary community-law: in 1979 the member states had still been strictly against a European law for nature

[55] [Jordan 1999]
[56] [Krämer 2002], p. 25 et seq. (translated by the author)
[57] [EU 04]
[58] which came into force in January 1958
[59] Art. 6 TEC

conservation (79/409 for the conservation of wild bird life), but in 1987 the EC-contract was changed to embed the possibility of finding Community solutions. In 1988 the court claimed that the conservation of bird wild life was a common European responsibility. Between 1988 and 2000 the destruction and depletion of the ozone layer led to a step-by-step ban of several ozone-destroying substances.[60] In 1976 an industrial accident in Seveso caused the community to work out a common provision for the avoidance of major industrial accidents[61], which had not been accepted before. The Europeanization of the market of the automotive industry and for products in general led to rules for end-of-life-vehicles[62] and for packing waste[63]. In these fields the progressive economic integration of Europe necessitated the elaboration of common environmental regulations, based on Art. 174 TEC.

2.4. Current Legislation Of European Environmental Law

European environmental law can neither be isolated from national legal systems nor can it be independent of general matters of the Community law. That is, because on the one hand, Community Law and National Law are correlated with each other, so that numerous mutual influences can be observed. On the other hand, the common environmental law is per se a part of the Community Law, so that its characteristics and specific features have to be taken into consideration, as they are playing an increasing role in the context of the growing importance of environmental law and political issues and their implications and challenges of international significance. 174 (1) TEC defines the bottom line of goals to reach within Common environmental policy and reinforce a statement of objectives of the EU environmental policy which are preserving, protecting and improving the quality of the environment, protecting human health, prudent and rational use of natural resources and promoting measures at international level to deal with regional and world wide environmental problems. 174 (2) TEC lists the applicable methods for the achievement of these objectives, laying down the guiding principles upon which environmental action must be based, being requirements regarding the content of Common environmental policy. [Epiney 2005] judges

[60] EC 2037/2000

[61] Council Directive 96/82/EC of 9 December 1996 (Seveso II)

[62] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles, in: Official Journal L 269 of 21.10.2000,p. 34

[63] Council Directive 94/62/EC of 15 December 1994 on packaging and packaging waste, in: Official Journal Nr. L 365, p. 10

this as "remarkable" compared to other Common policies where objectives are also outlined, but not the way to achieve them.[64] The "acquis" comprises approximately 300 legal instruments, mostly in the form of directives, covering environmental protection, polluting and other activities, production processes, procedures and procedural rights as well as products. Apart from laws that deal with cross-cutting issues (environmental impact assessments, access to information on the environment, combating climate change), quality and related emissions standards are set for air, waste management, water, nature protection, industrial pollution control, chemicals and genetically modified organisms, noise and nuclear safety and radiation.

2.4.1. European Community Environmental Action Principles

High-Level-Of-Protection Principle

According to Art. 95(3) TEC the Commission must consider a high-protection-level in their proposals (Art. 95(1) TEC) in the field of environmental protection (taking account of regional variations across the Community), just as the Council and Parliament must do. From the horizontal clause (Art. 6 TEC) and Art. 174 (2) sentence 1 TEC, it can be gathered that all environmentally relevant legal acts of the Community have to base their decisions starting from a high level of environmental protection However "high level of protection" does not mean "highest level" of protection, so that political and economic aspects can be taken into account. Further [Epiney 2005] assumes that the term "high level of protection" does not have an absolute but relative character, so that the definition of it has to take into consideration the circumstances of a certain region.[65]

Precautionary Principle And Prevention-Rather-Than-Remediation-Principle

Art 174 Abs. 2 Sentence 2 TEC says that the Community policy on the environment "shall be based on the precautionary principle and on the principle that preventive action should be taken, that environmental damage should as a priority be rectified at source and the polluter should pay." The **preventive action principle** concerns the defence of danger with (proven) relatively high likelihood. The **precautionary principle** can be seen to integrate preventive anticipation: it allows taking appropriate prevention-measures for even "only"

[64] [Epiney 2005], p. 97 et seq.
[65] [Epiney 2005], p. 99 et seq.

potential endangerment. This way intervention is possible before scientific proof is available on the grounds that a delay in the action will cause damage to nature and society although causality has not yet been proven indisputably.[66] The precautionary principle can therefore be seen to lower the "inhibition threshold of intervention". Considering the complicated interdependencies of environmental issues, the uncertain conditions of certain environmental problems and the persistence of insufficient knowledge (despite ongoing scientific research), this is an important step towards risk management. An example for an unrecognised environmental hazard is the use of CFCs that started in the 1940s: 30 years later scientists predicted that emissions of CFCs could lead to ozone depletion in the stratosphere. But the ozone hole over the Antarctic needed to be proved (1985) to bring about an environmental treaty (Montreal Protocol, 1987) eventually resulting in the ban of CFCs.[67] One therefore has to include the requirement that protective measures can be developed before specific environmental hazards are evident, so that necessary measures for avoidance and abatement of potential hazards can be taken without having to wait for scientific ascertainment or realization of a certain possible threat.

Proximity Principle

This principle implies that environmental pollution should be dealt with at the nearest possible source (geographically seen) and at the earliest possible point in time.[68] It parallels the precautionary and preventive action principle, since these also aim at the early control of environmental pollution. While the precautionary principle restores information under which conditions an environmental policy measure is to be taken, the point-of-source-principle implies when and where the measures are to be taken.

Polluter Pays Principle

The general idea behind this principle[69] is that the polluter should bear the costs not only for the production, but should also forced to internalise the external effects (environmental costs), paying for the costs of avoidance, abatement or repair, reflecting "true costs" of certain polluting activities. In combination with the precautionary principle the polluter should be encouraged to abate, and

[66] [UN Global Compact 01], Principle 7; [Epiney 2005], p. 101 et seqq.
[67] [UN Global Compact 02], p. 52
[68] Art. 174 Abs 2, sentence 2 TEC: […] environmental damage should as a priority be rectified at source […]
[69] Article 174 (2), sentence 2 TEC

should not only pay for the repair of existing environmental pollution but also for the costs of its avoidance. The idea of this principle is generally acknowledged but when implemented, several unsolved problems arise on the issues of causality, calculation, and percentage of cost-burden (etc.).

Integration Principle

The Integration Principle allows for the fact that environmental policy has cross-sectional character: "[e]nvironmental protection requirements must be integrated into the definition and implementation of the community policies and activities referred to in Article 3 TEC, in particular with a view to promoting sustainable development"[70].

Environmental policy cannot be seen isolated and can only be successful if environmental concerns are integrated in all coherent policies (for example as infrastructure, agricultural and energy policies). This principle therefore implies to concede co-existence of the demands of the different policies (including environmental policy), without assigning a position of pre-eminence to any policy.

2.4.2. Competences (Distribution of Power) in the EC

How is the distribution of power organized in the European Community and who is responsible for the enforcement of environmental issues? The European Union has no "all-embracing competence" for ecological questions that concern the Community. According to [Krämer 2002] this follows from the Articles 3, 5 and 174 TEC, dealing with the "Environmental Community Policy", not drawing a sharp line between the environmental political competences. As MS have the decisive task of implementing Common Environmental Law on a national level they certainly play a crucial role.

Primary and secondary Common law seem to provide a framework for the national governments, which can (within certain limits) considerably widen the scope, when adjusting legal texts to their necessities. Unfortunately, the framework's limits are blurred and the control of compliance is not feasible to the extent needed, therefore MS have a wide range of possibilities to deviate from principles set by the EU in their day-to-day business.

[70] Article 6 TEC

Although the Commission can open an infringement procedure according to Article 226 TEC If a MS is suspected to not applying Common law correctly, this comprises a 3 stage-procedure with an average duration of up to 4-5[71] years. IMHO this speaks for itself and the Commission cannot be seen as having sufficient capacities to enforce written law.

3. Economic Reasons for Governmental Interference

In this chapter it shall be discussed, why governments are actually interfering in the economy with respect to environmental issues. That governmental interference might well be needed in matters of reducing poverty by monetary redistribution (social equity) or safeguarding individuals and societal groups will not be the focus of this paper, although the environmental status cannot be seen completely detached, and there are major contributions to "environmental justice" already e.g. in the U.S.[72]. Generally governmental intervention will be justified, if the benefits for society outweigh societal costs.

3.1. Market Failures

The market mechanism based on prices and sales to adjust to the "optimal" level of resource allocation (cleared markets) may fail to provide the socially optimal combination of output, because of certain market imperfections of this mechanism, because supply and demand do not always lead to Pareto optimal points on the production possibilities curve. Following the definition of [Winston 2006] market failure occurs, "when it is possible to make one person better off without making someone else worse off, thus indicating some degree of inefficiency", hence not obtaining "Pareto optimality".

Yet again [Sagoff 1994] has been found to heavily criticize certain dogmas of the invisible hand doctrine, pleading on abandoning them, such as the proposition of neoclassical economics that "markets may fail to allocate resources efficiently, that is, to those willing to pay the most for them".[73] As a consequence he sees the interest in institutional context of production rising and turning towards empiricism - a postulation that can only endorsed by the author.

[71] [Krämer 2002], p. 33: according to his own count in the period 1998/1999 average duration 68 month, in the period 2000/2001 average duration 59 month.
[72] [Rutledge et al 2002]
[73] [Sagoff 1994]

In the following the main sources of market failure shall be explained.

3.1.1. Public Good "Environment"

Natural environment providing us with the supply of fresh water and clean air is understood to be a public "good". In economics, a "good" is something that increases utility or satisfies a want. Further a public good is a good that is hard or even impossible to produce for private profit, because the market fails to account for its large beneficial externalities. Natural environment is not produced but given (even regenerating and increasing, e.g. harvest), but is deteriorated at the expense of production of environmentally impacting goods.

A "pure" public good possesses the following properties:[74]

- Joint-supply: a provided good is available to the public at no extra cost e.g. if water quality of the Danube is raised because of more stringent regulation on sewage treatment, everyone who wants to benefit the improvement, can: consumption of one individual does not reduce the amount left for others (in comparison to e.g. food, that once eaten is not available anymore to others)
- Non-excludability: it is not possible to exclude a person selectively from the consumption of natural environment by prices as in private markets (in comparison to e.g. theatre, only consumed by those paying for the tickets). Over-fishing problems result from the impossible control (and charging) of the seas.

Markets can only provide private goods (excludable and rivalrous) efficiently tending to under-produce public goods and over-produce private goods. Why, is explained in the following:

3.1.1.1. Free-Rider-Problem

The free rider problem constitutes an answer to why the free markets do not produce the social optimum of the public good "environmental protection".

The insufficient provision of the good "healthy environment" emerges from the existence of incentives for individuals not revealing their real (full) willingness-to-pay as a consequence of the joint-supply characteristic of public goods: the production of public goods results in distributed benefits - nobody can be

[74] See e.g. [Brent 1996], p. 132; [Varian 1992]; [Bichler 1992], p. 10

excluded from the good once provided. Thus, it is possible for the individual to receive the benefit without contribution (at no extra cost) and is the resulting economic behaviour of a purely rational, gain-seeking individual (homo economicus) trying to minimize (own) costs to maximize (own) profits. The result is that private markets will provide suboptimal solutions. "If no one reveals what they are willing to pay, private producers cannot make a profit". Companies underlying the concept of profit-orientation would not voluntarily exert any extra effort, unless e.g. subsidies are provided by the government or regulation urges companies to "produce" environmental protection: free-riders are waiting for someone else to pay, trying to reap the benefits free of charge.

It has to be remarked, that there is also the phenomenon of non-individualistic behaviour: which incentives drive a company to overcomply with regulation whilst others tend to be environmental laggards? To some degree an explanation may partly be subscribed to the anticipation of additional tightening of regulations but all companies are faced with the fact that legislation is getting tighter, not looser. [Gunningham et al 2003] have tried to deliver explanations for these "variations in environmental performance" over time by an international examination of compliance-behaviour of 14 pulp and paper manufacturing mills, delivering complex reasons for the phenomenon of why some companies, but not others, tend to overcomply. One of their findings is that the "expectation of periodic tightening of regulatory standards has been responsible for beyond-compliance investments taken in anticipation of those governmental requirements"[75].

3.1.1.2. Tragedy of the Open Access (Problems of Overuse)

However, the public good "healthy environment" has become a scarce resource[76] and is limited to certain areas. Considerably clean air is not available in all parts of the world and therefore IMHO environment is to be addressed as a public good, with different regional endowments. E.g. fish stocks in the open seas are rival in consumption (but fishing trawlers cannot be excluded from catching fish) and therefore belong to the group of common resources.

Environmental protection problems that are related to free and easy access to resources[77] (because of missing or ignored property rights) appear to be a consequence of individuals maximizing their profits by behaving as rational,

[75] [Gunningham et al 2003], p. 17
[76] [Siebert 1995]
[77] suggested by [Turner et al 1994], .p 6 et seq.: to be distinguished from the "Tragedy of the Commons", referencing to the problems of common property owned by a community.

individual enterprisers. [Siebert 1995] gathers that the environment serves as "public consumption good, as a provider of natural resources, and as a receptacle of waste"[78] - all of these functions competing with each other. Misallocation results from scarce resources being available at no cost. Therefore the use of the scarce resource "environment" requires a price. In the absence of private property rights, no self-orientated individual has an incentive to restrict the own environmental damaging behaviour leading to overproduction of pollution by missing incentives for e.g. purifying sewage before being released into rivers.[79] The impossibility to install property rights to environmental goods such as "air" the phenomenon must in these cases be prevented by governmental interference, for example by installing coercive laws (that will result in fines for transgressors) or using taxes to adjust a price to environmental degradation.

3.1.2. Environmental Externalities

Market activities that create side effects affecting uninvolved (third party) individuals by imposing costs on (but also providing benefits for) them without taking these into account include "externalities" (either positive or negative). Interdependencies exist between the utility functions (or production functions) of individuals[80]: consumer goods sold to both the producer's and the consumer's advantage (increasing wealth) can include the negative externalities of air pollution reducing the public good "clean air" for dwellers near the company. If the ones benefiting from pollution are not equal to those suffering under the costs of pollution they have no incentive to take these costs into account, leading to external costs borne by others (unless this asymmetry is being offset by governmental intervention (for example by enforcing compensation payments).

As a prerequisite the impact has to be relevant to the individual's utility function and affect them, because when individuals don't care about external effect, although persistent, there is no external cost. Brent defines a potentially relevant externality to exist if "the activity actually performed generates any desire on the part of the affected party, A, to modify the behaviour of the party empowered to take action, B, through trade, persuasion, compromise, agreement, convention, collective action, etc."[81]

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[78] [Siebert 1995], p. XIII
[79] [Turner et al 1994], .p 79 et seq.
[80] [Brent 1996], p. 108
[81] [Brent 1996], p. 108

Environmental pollution is mainly produced by the economy at extraction-, production-, logistics-, packaging-processes (etc.) and the residual waste after consumption. If the physical impacts on nature (e.g. emissions to air, noise, acid rain) interact with humans causing "expression of distaste, unpleasantness, distress, concern, anxiety"[82] an uncompensated loss of human welfare can arise: external costs (or negative externalities). Examples for human welfare loss in literature are "health damage, morbidity and mortality increases, less pleasurable recreation experiences"[83].

3.1.2.1. Private vs. Social Costs

In 1920 Pigou distinguished between *private costs* (direct costs of activity borne by consumer/producer) and *full social costs* on society as a whole (being the full costs of an activity including externalities), showing that pollution produces external costs making social costs the sum of private and external costs, and that firms therefore overproduce polluting goods. (Free) market revenues exclude consumer surplus (as shown in the next chapter) resulting in over- and underproduction in private market activity.[84]

Only the measurement of external benefits and costs enables governments to correct coherent market-failures moving to market equilibrium by installing measures to adjust (shadow-) prices to negative external effects, so that they have to be internalised by the economy and by providing subsidies for positive externalities, taking into account monetary benefits for excluded factors.[85]

The market equilibrium can only be reached if external costs and benefits are integrated, but yet governmental interference is not always needed under the conditions holding for the Coase theorem.[86]

The Coase theorem[87] suggests overcoming externality problems by introducing property rights and holds under the conditions of a small number of concerned negotiation partners to obtain a socially efficient outcome. This is not the case with many environmental problems (e.g. the problem of climate change as a result of carbon emissions) and the existence of too many bargaining parties and asymmetric information would not restore a solution in a reasonable period at

[82] [Pearce et al 1991], p. 61
[83] [Turner et al 1994], p. 4
[84] [Brent 1996], p. 107
[85] [Brent 1996], p. 107
[86] [Brent 1996], p. 107
[87] E.g. in [Siebert 1995]

reasonable costs (because of transaction costs and delayed agreements). For the situations when the Coase theorem preconditions do not apply Pigou recommended tax (subsidy) instruments to internalising the externality according to the shadow price of the externality, constituting an increase of marginal costs (benefits). The social net benefit of such a tax is obvious, but it can also result in a segment of consumers being worse off.[88]

a) Production Decision Failures

As discussed above externalities impose costs on society in the absence of governmental regulation because producers do not take them into account: markets will under-produce goods that yield external benefits and over-produce goods that generate external costs. Seeing the problem from the macroeconomic view supply is beneficial for industries up to the quantity where their marginal costs equal marginal benefits (under perfect competition). But only internal (private) costs are taken into account and production will be continued neglecting environmental degradation (external costs) by further using environmental polluting production techniques or inputs (at lower individual costs, than more advanced cleaner technology) as long as it results to be more profitable: private companies do not concert their actions to maximize social welfare, but (tend to) only maximize their individual maximization of welfare. This is why industrial supply is not reflecting "the true costs to society of production of the good"[89], resulting in an oversupply (and excessive consummation of goods due to prices which are too low as shown down below) than the quantity socially desirable, if the market is left to itself. To restore the social optimum, the industry supply curve must be corrected to include marginal social cost of goods and activities, meaning that it needs to be corrected to include the marginal costs of (negative) externalities.

b) Consumption Decision Failures

Wanting to maximize their own satisfaction the consumption decisions of individuals may also fail to consider the interdependence of their consumption patterns impacting the well-being of others. This is because market demand only takes the anticipated private benefits weighed up against the purchase price in account. But when external costs are involved, market demand augments social demand (or vice versa for external benefits). To install sustainability of demand,

[88] Shown in [Brent 1996], p. 111 et sequ.
[89] [Krugman et al 2008]

full social costs and benefits must be reflected by additionally including accrued externalities.

3.1.2.2. Consumer Surplus

Measuring the Willingness to Pay (WTP) of individuals for certain goods allows one to measure whether there is an excess over the price paid to the WTP. This difference between the price actually paid and the price reflecting the real individual valuation is called Consumer Surplus (CS). One of the main reasons why (also perfectly competitive) markets fail to restore large projects is because they "fail to measure the full social benefits"[90] with the CS seen to be of growing importance respective to the size of the project. This is because benefits are involved that "occur away from the margin where market prices operate" and result in market failures by causing under-production "even for small, marginal levels of private market activity".[91] It is further stated that the "inclusion of the consumer surplus is therefore a crucial difference between private and public decision-making"[92]. But there are difficulties entailed with the unbiased measurement of the CS, which can be seen to be correlating with the free rider-problem.

3.1.3. Asymmetric Information

To detect situations in which the individuals suffer a utility decrease by the actions of another (hence, discovering an existent external cost) the individuals need information about the externality, its impacts on his utility function to start negotiations with the party causing the external effects. Let us consider an example of a pulp mill and the neighbouring dwellers. Monitoring air quality, water quality, etc. (ignoring the costs here) only delivers data. A transformation process of human intelligence has to turn "raw data" into information (or even knowledge) serving as the base for negotiation. In our example the dwellers would need to know, what level of air contamination of which chemical substances would cause which problems to their health (and what it would cost in respect to health care treatment and losses of life value). It cannot be assumed, that paper mills only build sites to individuals being experts in chemistry, physician, etc. Whereas "knowledge" requires that the right conclusions are drawn out of monitoring (sticking with the example) air and water quality it is

[90] [Brent 1996], p. 50
[91] [Brent 1996], p. 107
[92] [Brent 1996], p. 50

impossible to expect the average inhabitant to interfere with these subject matters. Of course these services could also be achieved by private companies, not only by governments, but the free-rider effect would presumably bias the covering of costs.

The author therefore agrees with [Esty 2004] stating that information gaps and uncertainties lie at the heart of many persistent pollution and natural resource management problems. But further argumentation that new information technologies have the potential to fill these gaps (expanding options available for addressing environmental challenges) is only partly shared. As stated before, all other classical economic theory inputs (Labour, Capital, Land) will always be subject to scarcity, but searching the internet for information regarding a topic, it is common to have so many "hits", that processing "all" or at least the greatest share of information available will take virtually "forever". Special fields of business administration such as "Business Intelligence" deal with the problem of e.g. extracting relevant information for a business from all sources available, but struggles with problems of data inconsistency and unstructured formats making the automated processing of data difficult.

Although the accumulation of information in today's modern world is expanding with enormous velocity and new media (such as the internet) enable distribution the problem discussed above is still persisting for societies as a whole. Information can be perceived as an asset, which requires correct management to counteract challenges such as the *decaying character of data*, "unprecedented growth" of *data volumes* and the simultaneous *increase in data extraction requirements* to obtain decision bases, mutually fuelling each other if it not managed adequately.

[Cerf 2007] even displays the critical dilemma of the exponentially rising (digital) data as a data-avalanche (having to be accumulated, indexed and stored) warning it could bury us (if not managed). With these arguments the author wants to make clear, that although information (or to be exact: data) might even exist, it cannot be expected of the individual to react in the appropriate way in respect to human limitation.

A crucial requirement to the new communication technology is the more contents and context related structuring of data in the Internet. The classification of sources according to academic, credible, first-hand sources and ontologies (e.g. Taxonomies, Thesauri, Topic Maps) are only in their infancy and the fast, bundled

retrieval of validated data (not requiring the engagement in troublesome search) still needs development.

If these preconditions will be fulfilled sometime ahead in future it will be "easier to identify harms, track pollution flows and resource consumption, and measure the resulting impacts", not only as Esty suggests making "possible a new structure of institutional responses to environmental problems"[93], but also making available to individuals impeding and hindering governmental failures - of course given that the other requirements are fulfilled: individuals who are motivated, concerned, have the capacity to involve (more details in chapter 2.2.2.).

3.1.4. Assymetric Market Power

Since this paper is on "economic power" (interacting with environmental law) the author would like to discuss this term in more detail:

[Boulding 1990] states that the concept of power involves many disciplines, i.e. political science, philosophy, physical sciences, social sciences.[94] The central question has to be to what extent and by which means one can get what one wants and how other people can be used in order to achieve above.[95] In [Clegg 1989] it is stated that power has historically been interpreted in terms of the ability of achieving goals.[96] In the analysis of power intentions are a driving force, i.e. what is intended to happen and the reasons people might have for their behaviour.[97]

[Boulding 1990] classifies the different types of power to be threat power (being of destructive character; Boulding calls this "the stick"), economic power (being of constructive character; Boulding calls this "the carrot") and integrative power ("the hug"). Boulding claims that it is integrative power (and not threat power as one might assume) that is "the most dominant and significant form of power", because without legitimacy (based upon integrative power) threats would be "naked".[98]

Power can be used to destroy, produce/create, exchange, and integrate (by building relationships). But power is subject to boundaries: first of all there is an

[93] [Esty 2004]
[94] [Boulding 1990], p. 9
[95] [Boulding 1990], p. 10
[96] [Clegg 1989], p. 2
[97] [Clegg 1989], p. 3
[98] [Boulding 1990], p. 10

"ultimate power boundary" (limited to the actions within the realms of the naturally possible for a certain individual in a certain period, widely differing between e.g. the President of the U.S. and a child), but it is further limited by other boundaries such as the "taboo boundary" (resulting in refraining activities that would be possible per se, but are judged to be a taboo) and further the boundaries of preference settings.[99]

Power is not the characteristic of a person - it is not possessed without relational conditions. A single individual cannot wield any power. Power can only result from relationships. As a precondition to use power over another person there must be the means of enforcing power, being punishment (or reward) and dependence.[100] But [Clegg 1989] argues that "[h]owever, reified power will rarely if ever occur entirely without resistance"[101] because there is a (close) relationship between power and resistance.[102] [Clegg 1989] further argues that those captured by the sovereignty of power may be unable to free themselves from this capture, i.e. the suppressed not being able to leave the state of dependence easily. The lack of ability to actually recognize their free will might result in non-decision making and therefore their negation of power.[103] Wielding power does not only comprise getting things done (e.g. another individual behaving in a way it would not have acted otherwise), but also preventing certain actions (e.g. by hindering individuals to act according to their personal preferences).[104] The phenomenon of power could be interpreted as a degree of possible influence in relation to the possible countervailing resistance.[105]

For further clarification it should be considered that wielding power is a behavioural structure derived from our social background, formed by the acceptance of institutionalised compliance to behavioural rules of society in every day life: [Radlingmaier 1989] argues that the legitimisation of power happens through a majority, i.e. many countries no longer believe in the monarchichal system, which gives power to the ruler "by divine right", thus paving the way for democracy.[106]

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[99] [Boulding 1990], p. 16
[100] [Radlingmaier 1989], p. 21; [Clegg 1989], p. 207
[101] [Clegg 1989], p. 207
[102] [Clegg 1989], p. 208
[103] [Clegg 1989], p. 2
[104] [Clegg 1989], p. 9 and p. 18
[105] See [Radlingmaier 1989], p. 21
[106] [Radlingmaier 1989], p. 21 et seq.

Individuals behave and act according to their own framework of values. However, according to [Radlingmaier 1989] a phenomenon occurs where individuals hold too much power: the focus shifts onto holding and increasing this power by using (any) appropriate instruments, despite existing moral values, making individuals acting morally amorphous and therefore power becoming an end in itself.[107] The reason for the abuse of power can therefore be seen as achieving an improvement in respect to personal advantages, but also in extending their personal power level (using power to increase power). Instruments of law that install better control and communication mechanisms (e.g. the availability of decision bases open to the public for better transparency) and direct voting as a principle of democracy are to be seen as instruments devoted to avoid such abuses.[108]

Personal character, property and organisations are sources of power and can be observed to be interdependent (to a certain degree): strong personalities tend to gain power through their status in an organisation, enabling them to increase property. Organisations need dominating personalities as managers, who have rhetoric talent combined with the means of persuasion and repression in order to subordinate others both to their personal as well as their organisations' objectives. In developed countries property might not give power as it has done in the past and the practice to buy political will is declining (at least in developed countries). However, the importance of financial means cannot be underestimated, because it enables trade-offs. Interactions between individuals (e.g. managers and government spokesmen) influence their view on bilateral power. Particularly the holder of power relies on voluntary subordination out of a matter of habit or self-benefit without having to enforce subordination.[109]

Organisations can be defined as social entities pursuing certain economic aims and having a formal structure, which ensures that the activities of its members are targeted to reach these goals. According to [Clegg 1989] the organisation can be seen to be an arena of decision and action: the result of the discourse between different people responsible for different disciplines.[110] This includes that employees have to serve the interests of the company, which, in case of collision, results in the individual no longer being orientated by his personal values, but subordinates these under the organisational aims, leading to actions (within their

[107] [Radlingmaier 1989], p. 21
[108] [Radlingmaier 1989]
[109] [Radlingmaier 1989]
[110] [Clegg 1989], p. 197

work) actually contravening their personal values.[111] [Clegg 1989] calls for the field of theory of organisation to give explanations how organisational structures produce disciplined obedience, arguing that the depiction of authoritative structures (organisation charts) is a flawed approach because they "rarely if ever conform" with reality (especially in very complex organisations).[112]

Market power is not only the ability to alter the market price of goods or services but also to influence regulatory circumstances. Especially if power is wielded in unequal relationships (where one is weaker to oppose) markets can fail.

3.2. Governmental Intervention

Market failures cause the need for governmental intervention. Because free markets show allocation problems causing the public good "healthy environment" to be restored below the level of the social optimum, governments need to impose mechanisms to restore it. To tackle problems of international scope governments even have to work together to reduce e.g. environmental problems such as river pollution, acid rain, etc.[113] Governmental intervention (in environmental issues) aims for adjusting socially optimal levels of production and consumption by internalising externalities, correcting demand and supply (e.g. provision of goods that the market does not supply or subsidizing/regulating the provision), but also picking up problems of (perceived) inequalities or inefficiencies. According to [Jaffe et al 2005] there are four strategies for governments to changing individual behaviour: informing, facilitating the change and giving incentives (making the change attractive), or enforcing the change (by imposing penalties). Whereas [Jaffe et al 2005] conclude, that information and facilitation are the strategy choice with "motivated" people, regulation is the alternative to pick with "strongly desired, discrete, detectable goals achievable in few ways". This is because monitoring is needed to ward off companies orientating at (wrong) market incentives (because of market failures). Overregulation can cause not only adverse outputs, but also reactions of resistance and rising costs of environmental protection. [Jaffe et al 2005] find that incentives are "the most reliable, efficient strategies, especially if the change is continuous, detectable, and achievable in many ways".[114] How governments can intervene in the market and exactly which conditions these measures are

[111] [Radlingmaier 1989]
[112] [Clegg 1989], p. 17 and 192
[113] [Turner et al 1994], p. 79
[114] [Balch 2008]

perceived to have in regard to environmental protection will be discussed intensively later on in this paper.

Conflicting Goals of Economic Players and Governments

The production of goods is not an aim by itself, but is driven by the aim to create income. Given that income is the difference between cost and price, companies clearly try to maximize profit by keeping costs down. If governmental action diminishes profits (by e.g. imposing a tax on used resources to safeguard public health), interests conflict, since the reduction of hazards is not borne by the general public (although the benefits are distributed to all), but only affects the regulated and the individuals amongst which these profits should have been distributed. The larger the missing share of profit, the larger the opposition can be assumed to be (and possibilities opening up for firms will be displayed further down in this paper).

But "profit maximisation" is not an explicit goal. All economic entities are faced with a plurality of aims (a system of set goals, not a single aim): apart from the financial targets (particularly profit, turnover, return on investment) there are targets regarding performance (aim to achieve a certain temporary, quantitative, qualitative provision of goods (or services) on a market), but also technical, social, ecological targets. Usually formal targets dominate private businesses and factual targets prevail in public administration. This can also be seen from the viewpoint of financial targets being crucial to the survival of private organisations (e.g. liquidity) but also monitored e.g. investors expecting a high rate of return on investment, which is not so for public administration also striving for cost-effectiveness, but in case of non-achievement does not discontinue a service/duty.

Whereas companies' aims are determined by secondary stakeholders[115] taking indirect influence and primary stakeholders[116] governmental goals are influenced by the perceived will of the respective share of public which they are recruiting their votes from, but economic power yet can bias the "perceived will" of the public and gain more importance. The greater the economic power, the higher the wealth the company creates in the country, the more policy might miss to create

[115] such as banks, political organisations and authorities (e.g. by granting structural development aid) etc.

[116] proprietors (having rights deriving from ownership), executives and employees (by downward delegation of these rights), auctioneers (attaching terms and conditions) and of course their customers

the social optimum, by firms using their economic power to attain their "private interests", which may (substantially) diverge from "public interests".[117] [Shaffer 1995] states that there is an "unavoidable interdependence of business and government in modern society." Because society depends on "the business sector for attaining macroeconomic goals such as growth in employment and national income, firms play a legitimate role in the public policy process by advocating policies deemed desirable with regard to business operation and competitive position."[118] Firms play a role in the development of governmental policies because they are the implementers of national economic strategies.[119]

4. Governmental Instruments of Power

As outlined earlier, market distortions exist and governments need to avoid market failures by measures directed towards reflecting real costs (full social costs), that if imposed entirely on the polluter result in high incentives to take actions that cost less than the additional pollution costs now bared. If it is left up to the polluter to consider how these costs can be saved within the company, the flexibility leads to more options that can be considered, minimizing pollution control costs. The idea is transferable from companies to entire sectors: flexibility described above adds up across companies, enabling to focus not only on the possible actions within one company but across the whole sector to choose the sources with lowest costs. Governments are thus able to give effective incentives to companies enforcing the (social) optimal levels of pollution (set) and generally there are two regulatory approaches for central modification of economies to ensure that environmental protection is allocated at the social optimum: the classical command-and-control- (CAC) mechanisms (performance standards, production technologies) and the market-based incentives approach.[120]

Command-and-control-mechanisms: with CAC being mechanisms with a high grade of interference on how the economy has to control pollution of course the flexibility of companies to adjust to these full costs effectively is lost, traded off against a high risk-reduction and control on governmental side: direct regulation is traditionally used to control abstractions from, and emissions to the environment and offer a great variety of possibilities for governments to reach their goals through direct environmental relevant regulations on the

[117] See e.g. [Shaffer 1995], p. 501
[118] [Shaffer 1995], p. 497
[119] [Shaffer 1995], p. 498
[120] [Turner et al 1994], p. 144

environmental behaviour patterns of producers and other subjects with an impact on the environment. Seen in the context of the polluter-pays-principle these environmental policy instruments shall aim for polluters tackling their environmental damage and arising external costs. As it is generally the case with direct regulation, governmental aims can be obtained to a very high degree through the high level of interference by the state, but at the same time can be seen to be the general disadvantage of instruments that mandate the reduction paths, because governments need to interfere in expert fields of knowledge: not only that the competence from companies how their environmental impact could be reduced efficiently is ignored and information regarding these issues has yet to be obtained by governments (by employing expert staff and gathering information), but also the variations of possible abatements are not considered leading to excessive costs for economies. Still the U.K. Environmental Agency states that these kinds of measures will remain a fundamental part of a legal framework and will continue to have an important role especially for point of source emissions, until other solutions can be implied.[121]

In certain situations other regulatory measures can be used, often in combinations, to deliver some of the same outcomes as direct regulation with greater flexibility, thus stimulating innovation and providing more cost-effective solutions. More **market-based instruments** for environmental policy and natural resource management are environmentally related taxes, fees and charges, environmentally motivated subsidies, tradeable permits systems, deposit-refund systems.

Applying the right approach is essential to achieving environmental objectives efficiently and effectively.

Modern regulation needs to be outcome-focused and risk based, clearly communicated to those regulated and delivered in a consistent manner.[122] The range of environmental instruments available has expanded as environmental policy has developed and also requires the provision of a number of economic, technical or fiscal instruments.

Ever since environmental policies began to achieve a certain importance, analysts have been trying to rank alternatives, by comparing their cost-effectiveness. At the same time policy makers are striving to determine the distributional impacts

[121] [EA UK]
[122] [EA UK]

of policy costs leading to an additional important classification regarding their political feasibility (e.g. the distortion of policy instruments costs on certain industry branches) playing a major role in the process of instrument choice. Distributional impacts can be considered across industries (but also demographic groups) and can according to [Bovenberg et al 2007] "be especially important, since industry groups often constitute a powerful political force"[123], further stating that "to the extent that industrial stakeholders wield significant political power, designing policies that achieve environmental goals while avoiding serious adverse impacts on key industries can enhance political feasibility."[124] [Bovenberg et al 2007] shows that instrument choice under the precondition of cost compensation to affected industries can "significantly alter the cost ranking", dependent on the degree of abatement: a rather small or medium degree of required abatement "can make the emissions tax more costly than command-and-control policies" (although emissions taxes are considered to be generally more cost-effective under circumstances where no cost compensation is required). Yet again, if abatement requirements are extensive "the emissions tax regains its status as the most cost-effective instrument"[125].

Based on [Turner et al 1994] the selection of environmental policy instruments is suggested to consider following criteria:

- Overall economic efficiency
- Information requirements (the less accurate information is required, the better)
- Administrative costs (the less complex and technical the lower the risk of failure or limited effectiveness)
- Equity (just distribution)
- Dependability (avoiding uncertainties)
- Adaptability (capability to adapt to changes)
- Dynamic incentive (encouraging continuous environmental improvement)
- Risk reduction (of environmental risks)
- Political acceptability (not radical, but subject to shared views)
- Economic resistance level (economic counteraction)
-

[123] [Bovenberg et al. 2007], p. 2
[124] [Bovenberg et al 2007], p. 2
[125] [Bovenberg et al 2007], p. 16 et seq.

When adopting fiscal environmental instruments MS must also ensure their implementation is compatible with the provisions of the TEC (most of all Art. 174 TEC: "MS must establish the need for a levy to solve environmental problems."), minding their Community obligations (and other obligations towards third countries covered by WTO rules).

Further it is stated at this point by the author, that a general precondition is assumed while discussing the instruments in the following paper: evaluating the instruments it is also assumed that they are effectively monitored and enforced by appropriate measures. According to [Lee 2008] decreased firm-specific regulatory intensity in Korea has not been a result of missing or less stringent norms, but of the decrease of monitoring and enforcement (because of political instability).

In the following subchapters environmental policy instruments will be displayed in a **descending** order, starting with the instruments characterized by the highest governmental interference to the measures including less interference.

4.1. Environmental Standards

The concept behind command-and-control is that regulated companies are prescribed what kind of efforts in pollution control they have to undertake. Environmental obligations regulating pollution can be binding **requirements** (specifying requirements for future actions to be taken) or **prohibitions** (impeding certain present actions) with a very strong, governmental interference level, because of the direct influence on economic behaviour and is a fiscal-neutral (but not cost-neutral) policy instrument.[126]. Under certain circumstances these measure are indeed necessary e.g. to impede further use of a hazardous substance by a ban. Despite the importance of this policy option regarding the regulation of hazardous substances and the success in environmental protection that has been reached by European standards since the 1980s[127] it is not regarded to be an efficient instrument dealing with environmental degradation abatement: the drawbacks are inflexibility and the complete overruling of economic constraints by not taking into account the abatement costs of companies, not reducing environmental degradation at minimum cost.[128] Further

[126] [Wicke et al 1991], p. 165-423

[127] [Krugman et al 2008], p. 477 state that due to imposing environmental standards have led to an overall reduction of nearly 70% of sulphur emissions to air.

[128] See e.g. [Krugman et al 2008], p. 477

the "blind" mandating of a solution to an environmental problem can prohibit other, more efficient possibilities. Therefore economic efficiency is low because the individual companies' MC of abatement are not considered, imposing unequal burdens for companies (because of different MC), lagging behind ongoing technical changes without restoring incentives for overcompliance. In respect to administrative costs there is the advantage of clear goals, but efficiency depending on information requirements may be an important tool and an appropriate measure in critical situations (were e.g. bans are needed). But on the whole firms' room to manoeuvre are curbed, entailing a high economic resistance level.

4.1.1. Regulating Emissions

Emission Control Norms constitute threshold values of pollution, mostly by setting emission-limits of certain pollutants to air/water/soil by a whole plant, but also by reduction-obligations for a quantified rate/amount of a certain emitted pollutant generally allowing regulated companies some degree of flexibility in how to respond to meeting set goals. An example would be the European Volatile Organic Compound Regulation, setting threshold values for solvent emissions of paint-using plants.

Product Norms (considering emissions) are threshold values determined for the emission of specific pollutants, which are not to be exceeded in the production of a certain product (and the emissions associated with its production). Additionally products can be bound to provide specific characteristics (e.g. catalyst) in order to reduce emission quantities and the usage of a product can be limited to certain requirements or to certain times of day and places (as, for example, a night driving ban for heavy goods vehicles). Another type of product norms could be labelling-duties of hazardous and polluting substances, which have to carry warnings and instructions of how to handle the product. [129]

4.1.2 Regulating Production Processes

These norms interfere with the businesses' value adding process by prescribing how (or how not) they should do what they do and costs can result to be higher than external costs (damage) caused by the polluter[130] and therefore will not be highly appreciated by economic response. Nevertheless it can in special cases be

[129] [Wicke et al 1991], p. 165-423
[130] [Wicke et al 1991], p. 169

a needed measure (as shown), were the economic losses of regulated companies are still outweighed by the limitation of resulting harmful effects, that would otherwise lead to higher societal costs (social cost optimality).

Input-regulations are applied on the production process, so that the producer can be urged to switch from e.g. the use of certain specified raw materials with a high level of environmental damage, determining maximum concentrations of pollutants in the production process or regulating a total ban of certain substances, as for example the use of chlorofluorocarbons (CFC) in the production of refrigerators, because the substance is (now) known to be a major contributor to ozone depletion.

Process norms regulate how and which technology is to be used in facilities and regulate their applied technology in terms of elimination, reduction or application of a certain production process. This is how industries can be pushed to apply methods that are environmentally friendly (or judged to be so by the government). As an example industries, whose production processes are accompanied by a high level of heat, will be regulated to reuse this energy. Benchmarking helps to evaluate and classify the performance, giving feedback for environmental leaders and sorting out the "laggards".

4.1.3 Regulating the Production

The production quantities of certain products that are subject to high emissions can be limited to certain amounts in a certain time period or area (in a geographical sense), and can in the worst case result in a production-stop of a certain product if required reductions in emissions cannot be met. A ban for settlement can be necessary to apply in certain areas such as natural parks or water reserves, but can also be a tool to avoid over-industrialization of certain regions, with immissions needing to be limited. The IPPC for example is a European guideline calling on the substantive concentration on the operation and permit of environmental relevant industrial plants (can be seen as the implementation of the precautionary principle) which investigates on (expected) environmental consequences of a project, based on an integrative concept.[131] Lessons learned from these evaluations can lead to not permitting ecologically incompatible construction-plans.

[131] [Epiney 2005], p. 254

4.2. Environmental Levies

The term 'levy' can be used to cover both taxes and, fees and charges[132] and is considered (according to OECD definition) to be an environmental levy, if the taxable base of the levy has a negative effect on the environment. "Taxes designed to reduce external costs are known as Pigouvian taxes."[133] Private marginal costs of pollution are forced to include the cause of external effects and therefore alter the supply of the polluting producer encouraging lower environmental degradation. Fiscal law (as part of public law) is particularly suitable to play a significant role[134] for environmental protection not only by installing a price to the use of environment (by market incentives to internalise external costs), but also to allocate financial resources that can serve environmental protection aims or be used to decrease other taxes which are perceived as distorting the economy. It can be assumed that opportunities of pollution (covered by regulation) control will be efficient, since firms will exploit all perceived cost saving opportunities, because of their flexibility to adapt (especially with a view to developing technologies available in future), therefore showing a great incentive effect[135]. This follows from the different levels of marginal benefits from environmental degradation. Only where the benefits are higher than the tax imposed on the environmental damaging action or substance it will be of further economic benefit to sustain these production processes.

If the financial function is dominating it can be seen as a way of implementing the Polluter Pays Principle. Generally these measures cover all compulsory payments to government levied on tax-bases deemed to be of particular environmental relevance. The revenues can accrue directly to the government budget or can be "earmarked" to serve particular purposes.[136]

As a further enforcement incentive measures can also only be applied above a certain level (imposed by the government), with the effect, that these costs are then related to revenues related to non-compliance.[137] Tax differentiation serves a similar approach by ascertaining certain types of decreasing levies with

[132] [OECD]; [EU 01]
[133] [Krugman et al 2008], p. 479
[134] [Bichler 1992], p. 10
[135] [Turner et al 1994], p. 162
[136] [OECD]; [EU 01]
[137] [OECD 1989], p. 101

environmental impact. An example would be the Austrian levy on the purchase price of cars depending on the emissions[138].

Economic efficiency could therefore be very high, but likewise is the information requirement, to find the optimal level of the tax (but e.g. price elasticity, market behaviour may be difficult to judge ex-ante). Environmental Levies enjoy a rather easy implementation (embedded in existing tax systems)[139], being flexible and even applicable to mobile pollution sources (e.g. trucks).[140]

Taxes can be 'unrequited' (benefits provided to taxpayers may not be in proportion to amounts paid), whereas fees and charges are 'requited' payments to the government (levied more or less in proportion to services provided; e.g. the amount of wastes collected and treated).

However, the level at which environmental taxes and charges are fixed is a crucial factor, because only an appropriate adjustment ensures having necessary effects on the market. As it can be learned from [Turner et al 1994] at least in the past these instruments were "tended to be fixed at too low a rate to achieve the environmental objectives the administrators had in mind"[141]. Further potential environmental effects of a tax, determined by the tax impacts on the producer and consumer prices in question, have to be seen in conjunction with the relevant price elasticity. These insecurities can result in too little environmental protection, because the tax is set too low. The opposite case with taxes being set to high will be well opposed by companies (and their interest representations) delivering an explanation for the finding stated by [Turner et al 1994] above.

It can be observed in literature that the implementation of variable environmental tax systems is judged very difficult if not impossible. Although the author recognizes that the opinion stated here cannot be undermined by practical experience, but the insights gathered into the Austrian Income Tax system generate another view to the problem: income tax law is a very complex system that allows for a multitude of refining paragraphs, exemptions, and special cases. The economy as well as the public have accepted the need tax advisers to find their most beneficial way to react to these rules. If in environmental law likewise it were aimed for the building up of a similar legal construction of imposed environmental levies, IMHO could very well be an appropriate measure to deal

[138] In German: "Norm-Verbrauchs-Abgabe" (NOVA)
[139] [OECD 1989], p. 72
[140] [Turner et al 1994], p. 162
[141] [Turner et al 1994], p. 164

with the complexity in tackling environmental issues and is perceived by the author to be a necessary future aim to proceed to and it could well be imagined that in future there will be environmental tax advisers, helping to find possible reduction possibilities of environmental degradation in order to comply better with law and generate savings on imposed taxes.

Product charges: related to environmentally damaging products produced, consumed or discarded. Product charges can for example be directed towards pesticides, gasoline, lubricant oil, non-returnable beverage containers (etc.) and install an incentive effect to reduce the use of environmentally harmful products switching to less damaging substitutes. Considering the demand for gasoline (an example of low price elasticity) the effectiveness of the measure can be "seriously inhibited"[142]. Further it is not the adequate instrument for products that are hazardous to health, needing to be banned completely.

Deposit Refund Systems: help avoiding pollution by potentially harmful substances, but also enable expert reuse or recycling of environmentally impacting products if return to collection point can be achieved: by installing an 'deposit rate' (extra fee paid at purchasing a good) and a 'refund rate' (amount of fee returned) serves as an incentive for handing back concerned products after use (the rates not necessarily having to be the same), rewarding environmentally appropriate behaviour. The success of the measure depends on careful calculation of rates and observation of return percentages in the system, further there are high set-up costs and requires a large amount of cooperation between producers, retailers and users. Examples are the collection scheme for mainly arranged in the scope of waste management such as scrapped tires, batteries, etc.

Emission charges: are charged on pollutant emissions into air, water, soil, but also noise. Since it can be flexibly related to the level and severity of pollution it can be seen to be a very flexible system with a high potential of incentive effect, where monitoring is practicable. The efficiency of this instrument is not only limited by technological and technical boundaries but can also only cover a certain amount of pollutants to be feasible.

Examples for Fees and Charges that are implemented in Austria as environmental instruments according to the OECD database are for example the Charges on batteries, Charge for tree protection (in Vienna, 100% earmarked for

[142] [Turner et al 1994], p. 162

the planting of new trees), Fee on hunting and fishing, Fee on municipal waste collection/treatment, Fee on water use, Fees for the import and export of animals and plants, Toll for alpine roads, the Vignette (for the use of highways) and wastewater charges.[143]

Examples for Taxes in Austria are the Austrian Energy Tax (16.835%) being a form of indirect earmarking, as the Austrian Provinces and the Communities get 11.835% and 5% respectively of the revenues transferred linked to promoting measures protecting the environment and energy-saving.[144] Also with the Austrian Mineral oil tax (4.88%) a form of indirect earmarking of the revenues can be observed: revenues are transferred to the Provinces (independent of their tax share) to promote public local passenger transport.

4.3. Contingent Liabilities

Another environmental instrument adjusting the legal framework to provide better protection of the environment are more stringent environmental liabilities and the introduction of compulsory environmental liability insurances. Environmental liability is holding polluters liable[145] for the environmental damage caused and should encourage socially efficient levels of prevention as firms faced with potential liabilities seek to minimize the total costs associated with their liabilities e.g. with proper waste disposal and waste avoidance.

Also **compulsory environmental liability insurances** install incentives for environmental sustainability: public or private proprietors involved in higher risk by the nature of their production processes, properties of the products sold or stored (or other economic actions) will be facing higher insurance costs, dependent on the level of environmental damage risks.

Advantages

Obligatory environmental liability insurance have the advantage of being a permanent payment (continuously incorporated into economic management strategies), but also help enforcing the polluter-pays-principle in the case of existing damage and due payment, without existential problems arising for companies.

[143] [OECD], without the claim on completeness
[144] [OECD]
[145] The principle according to which the polluter pays when environmental damage occurs, is already set out in the Treaty establishing the European Community.

Also in respect to the high technicality and complexity of potentially harmful substances environmental contingent liability can be judged to be a tool that manages to internalise the risks by the agitators, avoiding governmental interference (saving immense resource-intensive administrative costs, e.g. evaluation, passing, enacting and controlling regulation)[146] and is, according to [Wicke et al 1991], to be seen as the "broadest (regarding all areas of environmental burden) and the most comprehensive pivotal point, to increase self-interest in environmental protection".

The measures therefore are market-based incentive assigning cost to environmental risk, which is now influencing management decision aiming to minimize environmental risks in terms of keeping insurance fees down. Also indirect environmental damage shall be avoided or (given the case) repaired, relating to the precautionary principle and the measure is seen to be compatible with the personal responsibility principle dominating free market: companies on their behalf will have to consider how to hold the input of environmental burdening material down, increase re-usage, limit the production of environmental damaging goods). Also on European level it is concluded[147] that a Community environmental liability scheme establishing a Common framework for liability would be the needed step forward.

The Directive 2004/35/EC distinguishes between two complementary situations[148]:

1) Dangerous or potentially dangerous occupational activities[149]: the operator may be held responsible even if he is not at fault. Regulated under this first scheme are mainly agricultural or industrial activities requiring a license under the Directive on Integrated Pollution Prevention and Control (IPPC)[150], activities which discharge heavy metals into water or the air, installations producing dangerous chemical substances, waste management activities etc.[151]

2) All other occupational activities: applying to all other occupational activities, but only where there is damage, or imminent threat of damage. In this case, the operator will be held liable only if he is at fault or negligent.

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[146] see [Wicke et al 1991], p. 232
[147] [EU 03]
[148] Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage
[149] listed in Annex III to the Directive
[150] COUNCIL DIRECTIVE 96/61/EC
[151] [EU 05]

Problems:

But still Directive 2004/35/EC only applies where it is possible to establish a causal link between the damage and the activity in question.[152] Because of complex interdependencies of environmental problems more stringent elements of an offence of legal liability have to be designed, as for example

- Shifting the burden of proof to the accused party (because of causality[153] problems) with a possible solution lying in legal action as [Wicke et al 1991] states, that by enabling legal action instituted by an institution it could effect in rising economic risks through the eventuality of damage claims.
- Also with a view to threat of conviction and sentence environmentally damaging behaviour of individuals, as observed with fiscal delinquencies, could lead to deterrent personal risk-taking of responsible executives for environmental delinquencies.

Further the efficiency achieved by the means of liability strongly depends on the court systems, but also on the properties of the externalities at stake.

4.4. Tradeable Permits (Allowances)

Environmental allowances are an environmental policy instrument dealing with "rights on polluting", which can be seen as an approach of assigning proprietorship to the public good "clean environment", privatising its use to the politically negotiated level that environment is capable to absorb the permitted environmental damaging actions.[154] Environmental permits entitle the holder to the usage of environmental media by rendering a proprietor-related right (in the certified quota) to them. Since these "permissions to pollute" are needed in the adequate amount (at the rate of pollutants discarded through the production of a certain good) by companies, creating an environmental pollution-rights exchange market allowing environmental polluters to trade. These allowances can be either sold by the state (generating public income), allocated gratis to all pollutants or according to a certain criteria.

Tradeable allowances are a means whereby markets can be created by a small degree of governmental intervention to obtain a fixed (politically agreed)

[152] There are exemptions from environmental liability for damage resulting from armed conflict, natural disaster, etc.
[153] [Wicke et al 1991], p. 227
[154] [Wicke et al 1991], p. 207

environmental standard (e.g. a certain level of emission), by generating a market price for certain environmental degradations (such as pollutants emission or nuisance-action). Attaching a price this 'factor' has to be accounted for and in terms of lean production can be implemented in managerial decisions on cost-cutting and therefore not only in reducing emissions per se but also triggering the (invention and) application of cleaner (because cheaper) production methods limiting environmental damage. If the demanded amount of allowances exceeds the amount offered by the state (limited by the maximum tolerable pollutant emission) the price of allowances goes up. Therefore tradeable emission permits can be seen to reduce pollution where it is the cheapest and can be rated to be economically efficient.

Examples are of course the licensing for certain heavy polluting companies, but also for motorboats on rivers or lakes, or for (coastal) fishing. To mention an interesting example put up in [Krugman et al 2008] on the licensing of lobster-fishing: in Australia setting lobster traps requires a license costing about 21.000€. With the fishermen being sceptical at first, they are now stated to be enthusiastic about this system, because unlike in other regions of the world their lobster catches have not only increased in quantity but also in quality (bigger lobsters). Maybe this example shows, that industry resistance is equivalent to possibility to perceive chances of increasing private interests by regulation.

Examples and Characteristics of Trading Schemes

The concept of tradeable allowances has already been put into practice in the EU in the context of environmental policy (Montreal Protocol, packaging waste recovery note (and export note) system), the Common agricultural policy (dairy quotas, tradeable development rights for land preservation, nutrient emission rights for farmers) and the fishery policy (tradeable fishery (catch) quotas). In the EU Emission Trading Scheme for CO_2 or other greenhouse gas emissions trading schemes a system was established whereby companies are allocated with allowances for their greenhouse gas emissions according to the overall environmental ambitions of their government.[155] If companies face a cost for e.g. each tonne of carbon they emit, carbon emissions have to be treated as a cost in their investment decisions (these former externalities are now internalised) and different options available for reducing this economic impact will be explored (including switching to less carbon-intensive forms of generation).

[155] [EU 06]; Green Paper COM(2000) 87 final; Communication COM(2000) 88 final

The main **characteristics** (according to the [OECD]) of the tradeable permit systems used in environmental policy are listed below. These types of permits system can be distinguished:

A 'quota system' establishes a quantified ceiling or floor assigned to each participant for a given period. There are different types of quotas systems referring to the situation of the initial allocation. The allocation of allowances is a difficult, but crucial decision: sectors and companies to be involved have to be determined. Regarding synergy with other policies, it has to be clarified how technical regulation, taxation and environmental agreements are respectively substitutes for or complementary to the trading instruments. There are following types (that can be also be used in a mixed strategy): (1) Auctioning - quotas are sold to the highest bidders, (2) Unconditional grandfathering - quotas are distributed for free according to some criteria (e.g. historic production or historic emissions), without any particular conditions attached (3) Conditional grandfathering - certain conditions are placed on freely distributed quotas, e.g. that production within a given region/factory has to be maintained (e.g. Belgium: nutrient emission right for farmers).

In a 'credits system', a baseline development has been agreed before the start of the period. The participant is credited with any over-achievement at the end of the period, and is allowed to trade the credits. In the UK's "GHG Emissions Trading Scheme" for example permits for GHG emission under the cap are traded and credits are given for emission reduction against baseline under the "Climate Change Levy Agreements". With averaging, the authority sets average limit values for a range of similar products manufactured by firms in the same industry.

'Transferable usage rights' (e.g. Belgium: nutrient emission right for farmers) involve licensing the use of natural resources that previously were freely available, or whose ownership was shared. But there are also other possibilities.

Trading, Banking, Borrowing, Bubbles and Interzone-trading can be allowed or restricted and specifications of what and who is allowed to trade are needed. The administrative costs and possibilities of types of monitoring the system are of interest but very hard to obtain (no entries found in [OECD]). To give an example the Belgian quota system trading tons of CO_2 emission allowances uses a monitoring protocol in environmental permit consistent with EU monitoring and reporting guidelines. Some systems foresee sanctions for non-compliance: excess

taxes per ton for emissions exceeding the quotas (e.g. Denmark, Belgium 40€/ton CO_2), fines in case of misreporting of companies or emitting more than allowed (example in farming: more animals are kept than allowed), others again have no sanctions involved. Sometimes explicit links between a tradeable permit system and other instruments used in environmental policy exist (e.g. voluntary agreements) or foresee special arrangements regarding linkage of instruments (e.g. in the U.K. GHG Emissions Trading Scheme participants of the Climate Change Agreements receive an 80% discount on the climate change levy).

[Petsonk 1999] states that "the emissions trading structure of the Kyoto Protocol deploys a rule-based system of "free trade" in emissions allowances to benefit the environment" with at the same time suggesting that environmental and economic benefits can be maximized if governments "refrain from raising non-tariff barriers to trade in emission allowances, and avoid imposing quantitative restrictions on, or arbitrarily discriminating against, such trade" to be compatible with their responsibilities under the multilateral trading system (WTO).

Advantages

Companies are faced with the decisions on whether to sell allowances and install pollution abatement (that is cheaper than the selling price; creating revenues), to outsource, or to buy additional allowances. Firms will however choose to minimize their individual costs, at the same time restoring general efficiency and leaving the market to organize itself being a scheme that allows a degree of flexibility without disadvantage to the environment. Furthermore the development of new technologies is encouraged and does not build market entry barriers: any company capable of holding producing at a competitive level can enter the market. Administrative costs for governments are low because they only have to set the goal (e.g. maximum value of emissions of a certain substance) and control compliance. (Forced) switching costs that arise with the sudden coming into force of top-down-regulations is countervailed. Only a framework is restored, but leaving economic responsibility and the freedom of choice with the economy.

Disadvantages

It is difficult for governments to determine the social optimum pollution quantity, needed to calculate the quantity of permits to be issued. It will again be subject to pressure of concerned companies to influence governments to issue too many

permits[156], resulting in too small environmental impact, not attaining the optimum level of pollution. Further there is a risk in suboptimal concentration of pollutants, which can still exceed certain hazardous levels and must be either only applied regionally or combined with another regulation measure.

Another problem arising is the risk taken by companies in assigning the correct value to the "emission grant", that is tradeable. This combines knowing how high demand will be and where the marginal costs lie for the industry, to anticipate how the price (determined by buying or selling decisions) will develop. As it has been shown from the experiences with the EU Scheme this year, the lack of experience of companies with this value, and obviously an oversupply of allowances has resulted in a break down of the market price. The environmental allowance trading requires expertise and has yet to develop and institutionalise. The risk is therefore seen to be shifted on to the economy. Missing experiences with such new instruments may lead to increasing resistance of companies following risk-averse strategies.

As with other measures vast problems on the control of compliance exist[157] and are expected to increase with the complexity of the measure.

4.5. Subsidies

A subsidy can be considered as a "negative tax," and could theoretically be as efficient as pollution taxes, although in literature it is stated that it is "almost never observed."[158] However, a government may subsidize production of a public good (internalising positive externalities) in the private sector, resulting in some form of a competitive market (unlike with governmental provision). But also subsidies can result in governmental failure: deciding which companies exactly to subsidize for which action and in which quantity is crucial and important to make this costly instrument efficient. Besides, subsidized companies have incentives to be less efficient (relying on the state funding). Further the subsidy granted to certain companies distorts the market for other companies that may even provide environmentally superior substitutes, driving these out of the market.

[156] As it has shown to have happened with the allocation of permits in the EU programme.
[157] [Wicke et al 1991], p. 349
[158] [Microeconomics 2005]

Subsidies can refer to many different types of policies, such as a subsidy for technological change (e.g. catalysts), to the production of a (public) good, or can take the form of a direct payment to polluters for reducing emissions (per unit of reduction relative to a baseline). This last measure mentioned could be biased by companies trying to increase the baseline, resulting in inefficiencies: only "when the baseline is exogenous to the firm and there is no deadweight loss to taxation, a subsidy achieves the cost-effective pollution outcomes for a given set of firms"[159]. Further the measure gives incentives to companies to stay or even enter the field and may lead to an overall increase of pollution by the industry.[160]

Subsidies for activities respecting environment and contribution to the reduction of environmental pollution can be granted voluntarily. These can either be given out deliberately or be involved into a sort of open contest with the "best" entry being redeemed with a financial "award". E.g. in Netherlands the purchase of ecological areas by private conservation organisations can be subsidized.

Advantages:

Depending on what is meant to be achieved, conditions can be applied regarding who and which projects should be subsidized, giving the state the possibility of selectively boosting the economy with targeted projects, since the state can lay down all the rules, without needing to oppose economic resistance.

Subsidies can also be used in areas with a potential for non-individualism: for instance, a state may subsidize devices to reduce air pollution and appeal to citizens to cover the remaining costs. Environmental policy subsidies can be used to increase energy-efficiency for professional activities (e.g. supporting applied or industrial research), investments support (e.g. adoption of modern (ecologically concerned) equipment or production methods), but also financial aid for compensating income losses.

Disadvantages:

The **potential for cronyism** (for example, an alliance between political insiders and the businesses receiving subsidies) can be limited with secret bidding for the subsidies or the application for subsidies following clear general principles. Depending on the nature of a public good and a related subsidy, principal agent

[159] [Microeconomics 2005]
[160] [Microeconomics 2005]

problems can arise between the citizens and the government or between the government and the subsidized producers; this effect and counter-measures taken to address it can diminish the benefits of the subsidy.

The need to avoid "perverse subsidies": Operations have to be scrutinised in order to exclude those projects which promote different forms of "perverse subsidies" as they can be found to support the replacement of state owned monopolies by private or public-private ones e.g. in the energy sector. The fast-paced liberalisation of the energy market in Central, Eastern and South-Eastern European countries leads to lowering restrictions by governments to attract private investors[161], sometimes transferring benefits to potential investors that go far beyond normal market incentives such as long-term contracts for the buy-out of energy at fixed prices, budget funding for research and impact analyses, agreements for future privatisation on special conditions, lower pricing of already existing state-owned energy assets. "Patching" activities (keeping "dirty parts" such as environmental liabilities for nuclear accidents) have to be viewed critically. Some even being of the opinion that all such subsidies – open or hidden – distort a future free market on the energy sector and predetermine a number of problems for the consumers and taxpayers. "Perverse subsidies" could maintain a high ratio of fossil fuel and nuclear-based energy, thus effectively blocking the growth of cleaner and safer forms of energy production.

Further the mentioned above disadvantages of market distortions can occur: e.g. other environmentally effective products (substitutes) may face sales problems because of the competition of artificially low (because subsidized) prices. Further the crowding out effect is implied.

Different forms of environmentally related subsidies exist, which are explained in the following:

4.5.1. Grants

Grants are financial supports (also in form of a compensation for financial losses) on investments with a positive environmental impact up to a certain percentage of total eligible investment costs linked to conditions concerning the project (e.g. feasibility study, organic production techniques in agricultural projects, types of trees planted in afforestation programmes) and can be graded relating to the size

[161] [NIRS]

of the company concerned. A practical example of supporting environmentally sustainable investment costs are Wallonia's "subsidies to increase energy-efficiency for professional activities" granting 50 to 70% of expenditures to small and medium sized enterprises (SMEs) and up to 50% of expenditures to large enterprise. Grants for forestry management beneficial to the environment (afforestation, endangered species conservation) can take the form of compensation payment amounting up to income losses or increased maintenance costs compared to customary forestry practices. In Wallonia a reward of 200€/ha is granted for leaving fields to natural meadows.[162]

4.5.2. Soft Loan, Subsidized Loan

This is a form of support of financing eligible projects via special state-provided loans for business entities (companies, state enterprises, co-operatives, entrepreneurs) providing soft loans from state-owned banks or interest rate subsidies for loans taken from commercial banks. These funds may subsidize up to 100 percent of the loan interest for a certain period, mostly capped by a maximum amount of interest subsidy or limited by a certain percentage of total investment costs to be covered (e.g. 50%). Form of support (soft loan or subsidized loan), amount of subsidy (in case of a subsidized loan) and the projects eligible for financing (selected on environmental and technical criteria) depends on priorities set for the environmental performance of the project. There are also different options on the financing period and repayment periods (also regarding grace periods) and systems used: the Czech Republic has installed an "Energy Performance Contracting" with the loan being paid back on the basis of realized energy-savings. The program is operated by special firms, allows preparation of an energy saving project without ex-ante spending of investors' money and focuses on environmental audit, proposal of measures, control and training.[163] In the Netherlands, to bring up another example, the "Loan for green projects" offers an interest rate 1.5% below the market rate financed by income tax exemption on dividends from Green Funds. But also interest rates with an

[162] [OECD]
[163] [OECD]

average rate of 2 (or even higher[164]) percentage points below the market rate are to be found.[165]

Other forms can also be grants combined with a loan: in the event of this combined support, the grant or a part of it may be substituted by an additional soft loan (applying to certain conditions). In the Czech Republic the State Environmental Fund is entitled to change the required percentage of proportion and financial volume of grant and loan within the framework of conditions for a given programme of support.

4.5.3. Loan Guarantee

Security loans that are guaranteed by the State can be given in a few cases with high risk: e.g. loans for pollution control investments (e.g. in the Netherlands security loans for land decontamination for small and medium enterprises with 90% security and max. 908,000€ are granted.)

4.5.4. Allowances

Allowances can be made to constitute and favour ecological 'good behaviour'. Considering the use of for environmentally friendly vehicles, allowances could be made by not charging road fees (or vehicle registration fees) for cars completely driven by alternative fuels (and reducing costs partly for cars with hybrid energy consumption).

4.5.5. Accelerated Depreciation

An example of a fiscal possibility concerning the subsidization of ecologically focused investments is the accelerated depreciation, which is of course only available to companies committed to accounting. In Finland these are available for investments regarding air and water pollution abatement and cover up to 25% annually.

[164] Interest rates were around 6% in 1999 and 7% in 2000, while average market rates for loans with maturity over 1 year were 12.4% in 1999 and 11.4 percent in 2000.

[165] in [OECD]: Regional Environmental Center for Central and Eastern Europe (REC), 2002, Environmental Funds in the Candidate Countries, S. Speck, J. McNicholas and M. Markovic (eds.), Szentendre, Hungary.

4.5.6. Tax Exemption

The range of possible measures where taxes actually imposed by other laws can be exempted by environmental law reach from income tax (e.g. income tax exemption of forestry owners in Netherlands), corporate tax, value added tax and excise duty exemptions (e.g. Lithuania exempts fuels obtained from biological raw materials from excise duty: motor fuels and gas oils mixtures with bio-fuels are taxed at a reduced rate, proportional to the share of biological raw materials in the product, zero tax is applied to bio-fuels).

4.5.7. EC Financial Instruments

LIFE program: To guarantee the operation of the internal market the Community has introduced a Common financial instrument called LIFE program[166] which aims to contribute to the development, implementation and updating of Community environmental policy legislation. The integration of environmental issues into other policies should be facilitated and sustainable development achieved (by co-financing).[167] Projects financed by LIFE must meet general criteria (contributing to its objectives, feasibility and technically and financially sound partners). LIFE consists of three thematic components (LIFE-Nature, LIFE-Environment and LIFE-Third countries). The distribution of financial resources is as follows: 47% of the total budget for LIFE-Nature, 47% for LIFE-Environment, and 6% for LIFE-Third countries. 95% of the budget is granted to projects and 5% to accompanying measures.[168]

Cohesion Funds: Art. 161 (2) TEC calls for the support of economically weaker MS in the realization of Community activities.

4.6. Environmental Agreements

How can the state act apart from legislation? General non-binding actions of the EC are Recommendations, Opinions, Communications of the Commission (Green or White Papers), Environmental Policy Action Programmes of the EC and Environmental Agreements (covenants). Legally non-binding communication often prepares legislatory measures and provides the basis for future law-development and can reflect the political orientation of European legislators from which

[166] Regulation (EC) No 1655/2000
[167] [EU 07]
[168] [Epiney 2005], p. 244

conclusions can be drawn on order to predict future trends in Common legislation. As a result these proceedings can have a certain steering effect on the economy adjusting to recommendations (anticipating future changes in law).

Environmental agreements are environmental co-operation solutions by which governments can implement their environmental concerns either by bilateral (binding) contracts or non-binding arrangements with certain pollutants. Target groups are either industrial sectors or associations, but also establishing environmentally concerned associations.

The objective of environmental agreements is to improve environmental performance of companies and implement sustainable production methods by encouraging voluntary commitments and agreements.[169] The aim of such agreements is often to prosecute deliberate obligations of the industry and economy respectively on certain environmental political objective targets, so that they obligate themselves to a certain "good conduct" being rewarded by the "getting around" of legally binding licensing requirements and orders.[170]

Binding bilateral contracts with industry sectors lay down environmental objectives to be achieved, and a time-plan to be met for achieving these, sometimes an agreement on certain measures achieving this goal, occasionally financial incentives monitoring methods and regulations for non-compliance (penalties).

Furthermore the Communication[171] lists six criteria, which should be met (inter alia) as the base of evaluation of the success of environmental agreements.

1) The evaluation of the agreements should take account of the cost-benefit ratio and only used if a saving on administrative costs can be achieved (administrative costs should not be higher than those of other instruments available).

2) Regarding the signatories to environmental agreements it is suggested that these should represent the majority of the involved economic sector and should be responsible and organised.

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[169] [EU 09]: In accordance with the sixth Action Programme for the environment

[170] [Epiney 2005], p. 28

[171] COM(2002) 412: Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions of 17 July 2002 on Environmental Agreements at Community Level within the Framework of the Action Plan on the "Simplification and Improvement of the Regulatory Environment

3) The objectives of the agreements must be clearly stated, by unambiguous formulations. Reliable indicators to measure the extent to which objectives have been achieved must be installed. For agreement covering long period, intermediate objectives must be specified.

4) Agreements, relevant reports and accounts should be accessible to the public on the Internet with the possibility for interested parties of the public making comments.

5) Environmental agreements should include a monitoring and reporting system for achieving the objectives.

6) And elements of sustainable development and consumer protection matters need to be incorporated in agreements.

Potentials and Advantages

There are three different potentials for development of environmental agreements:

- Agreements initiated by stakeholders in fields where there is no drafted legislation.
- Agreements adopted by stakeholders in response to the Commission's stated intention to draft legislation.
- Agreements ensuing from an authority's initiative.

The advantages of such agreements are that effective and tailor-made solutions lead to fast (or at least faster) achievement of environmental objectives and enable economic and social operators to be more dynamic because of simplification. Regulatory systems can be improved by ensuring a high level of legal certainty. Additionally these instruments can be seen as requiring a proactive approach from industries, allocating responsibility to the economy.[172] Moreover this instrument can doubtlessly be judged to offer the highest flexibility to both regulator and regulated. Flexibility, without resulting in administrative overload can be seen to be a pivotal success factor for environmental economic instruments. This is also pointed out by [Gunningham et al 2003] finding that "when regulators are more flexible in enforcing prescriptive rules, many firms have been willing to devise and invest in non-required methods of responding to regulatory values." Partly this is for efficacy reasons (firms know best themselves

[172] [Epiney 2005], p. 30; [EU 09]

where they can save costs) and partly it is found to be beneficial to "develop cooperative and mutually trusting relationships with regulatory officials".[173]

In the Communication of the Commission form 2002[174] the commission starts to concretise the perspectives of environmental agreements on Community level and lists sectors relevant for agreements in which the Union is currently striving for environmental agreements naming specific fields such as product regulations, waste management and climate policy (climate change). The agreements should present a real added value with regard to the level of protection of the environment.

Limitations

[Petts 2000] states that it is an emerging point of agreement that environmental policy efficacy and implementation efficiency are most likely to be achieved by an appropriate balance between command-and-control and self-regulation methods. In a survey on SMEs in England and Wales the paper explored attitudes on the importance of compliance with, and the effectiveness of, regulation. Compliance with regulation is viewed as morally right however, the effectiveness of regulation is questioned (whether all regulation is relevant to environmental protection) and there is a strong demand for consistent regulation to ensure a 'level playing field'. [Petts 2000] has found that the majority of SMEs are not taking any, or only minimal, steps to self-regulate - although seen as an opportunity because of the perceived weakness of reactive regulation.[175]

4.6.1. Self-Regulation

Self-regulation concerns agreements, which are made among the social partners, economic operators, NGOs or associations in order to regulate and organize their activities. On Community level the parties themselves generally take these initiatives. The Commission can encourage and recognize them. The contractors thereby agree to decrease a certain environmental degrading action or oblige themselves to a certain environmentally friendly measure.

[173] [Gunningham et al 2003], p. 21
[174] COM(2002) 278: The Action Plan on Simplifying and Improving the Regulatory Environment
[175] [Petts 2000]

4.6.2. Co-Regulation

Co-regulation concerns agreements concluded in the framework of a Community legislative instrument falling back on agreements on the basis of Common secondary law. The details for implementation are set out in the agreements. In general, it is the Commission that takes the initiative for such agreements, proposing that the legislature make use of them.

Communication in the negotiation process between the Commission and the polluters that are "under pressure" to install "self-regulations" are not published, therefore it is hard to take insight in the process and which instruments of power were used on both sides forming the outcome of these negotiations resulting in recommendations from the Commission directed at the Associations.[176]

From the example of the European Automobile Manufacturers' Association (ACEA) being an economic interest group representing thirteen European car, truck and bus manufacturers at EU level, obligating "itself" 1998 to lower CO2-emmissions of new vehicles to 140g/km after 2008, and the largely concordant formal obligations of the Japanese Automobile Manufacturers Association (JAMA)[177] and the Korean Associations (KAMA) it can be gathered, that industries will only obligate themselves to restrictions, that are perceived to be necessary anyway.

4.7. Other Instruments

4.7.1. Governmental Public Relations

The absence of a European point of view, European discussion and European media focussing on the "general interest" does not promote the quantity and quality of European environmental law, orientations in environmental politics, nor enhancement of the environmental aid.[178]

Governments should maximize the use of other opportunities and legal authorities to address environmental issues and expand public involvement. The public (including businesses, academia and community organisations) should be informed timely about environmental issues, participation in environmental decisions facilitated (e.g. improving community access to data) and responds

[176] [Epiney 2005], p. 29
[177] [JAMA 01]; [JAMA 02]
[178] [Krämer 2002], p. 25 (translated by the author)

evaluated, because an active, informed citizenry is critical to the success of environmental initiatives. Only individuals being aware of their personal environmental impact can behave eco-efficiently and can use purchasing and investment powers in a sustable way. Universities play a vital role as they are more insulated to political bias of environmental concerns and could be a credible and trusted source of scientific advice to the public.[179]

4.7.2. Information Disclosure

Public disclosure of environmental performance data (e.g. carbon disclosure) can play a role overcoming information asymmetries, and aid market decision-making. It can increase economic risk for firms involved in the production of environmental damaging goods (or undertaking environmental damaging behaviour), because it can lead to image loss, decreasing customer satisfaction and hence, profit losses. Instruments proliferating information provision programs are e.g. U.S. Toxic Release Inventory (TRI) or the declaration of the emission values of CO_2 of cars.

4.7.3. Environmental Labelling

Governments can additionally trigger non-binding environmentally friendly behaviour of companies by setting a "clear, explicit, and specific terminology" framework for the "eco-labels", enhance the reliability of eco-labels by requiring the producers to reveal information on standardized factors and by reducing existing labels serving as a transparency advantage to the consumer. Intensive communication to the public on the meaning of accepted labels being compliant with the frameworks should lead to higher public consumer choice.[180]

4.7.4. Industry Partnerships

The Environmental Protection Agency (EPA) of the U.S. has started voluntary industry-government-partnerships with all branches of industries. These partnerships are built in many different industry sectors to promote improved environmental performance with reduced regulatory burden. Theses voluntary collaborations between U.S. EPA and businesses are e.g. programs to encourage companies to develop long-term comprehensive climate change strategies and set GHG emissions reduction goals, but also compliance and assistance programs

[179] See [EA UK]
[180] [Wicke et al 1991], p. 165-423

with business Initiatives and compliance assistance information and programs designed to help businesses incorporate environmental considerations into the design and redesign of products, processes, and technical and management systems. [181]

4.7.5. Awards

Public opinion surveys show that Europeans are more worried about the environment. This reflects growing awareness among Europeans of environmental problems and increased commitment to protecting the planet's vital resources. Seven out of ten Europeans believe that environmental protection and fighting pollution represent "an immediate and urgent problem".[182] Our health and quality of life and that of our children are dependent upon the state of the environment, and are therefore a general concern. The environment is not just a matter for experts. It may be a complex and varied subject, but every shareholder, whether representing industry, public authorities, citizens, or NGOs, must be fully involved and committed to the cause.[183]

European Business Awards for the Environment

The Awards (presented every two years in four categories) are awarded by the European Commission aiming to recognize and reward outstanding corporate contributions to sustainable development of European companies, which set an example by successfully bringing together innovation, economic viability and environmental concerns. Reflecting growing business interest in contributing to environmental sustainability, the competition of 2006 attracted a record of 139 entries from 23 countries.[184] This is the highest number of entries submitted in the 19 years history of the European Business Award for the Environment and is an indication of businesses' growing interest in taking care of the environment.[185]

Global 500 Forum Laureate Roll of Honour

The UNEP established the Global 500 Laureate Roll of Honour[186] to recognize the environmental achievements of individuals and organisations around the world.

[181] [EPA]
[182] [EU Awards]
[183] [EU Awards]
[184] [EU Awards]
[185] [EU Awards]
[186] [Global 500a]

Toyota Motor Corporation for example has won this award 1999[187] for developing and introducing Prius to the market, the world's first passenger vehicle in production powered by 'hybrid power train system', which offers twice the fuel efficiency compared with conventional vehicles and cuts emissions of certain pollutants to about one tenth. Another winner was e.g. Fuji Xerox Australia[188] in 2000 for solving a significant environmental problem in the area of forest management: responding to poor sales of existing 100% recycled papers (which the market deemed to be of poor quality, expensive and unreliable) the company developed (after extensive research) recycled copy paper to precise specifications for use in digital equipment.

5. Government Failures

However governments, just as the free market, do not necessarily produce optima. With "government failure" the systemic problem is addressed preventing governments from efficiently reacting on market failures by working out unbiased solutions. Failures occur because, just as with market failures illustrated before, governmental institutions and their decisions are determined by the same individuals: "political decisions are not handed down from on high by omniscient beings who cannot err"[189]. Why should the behaviour of individuals in the market differ from those in political processes? [Turner et al 1994] even shows "that governments are very often themselves the cause of environmental degradation" (unfortunately) being "often not better than the free market". Powers are not necessarily used to provide "healthy environment" in the socially optimal quantity. Also [Langford 1999] reports on a "growing literature on failed states"[190]. [Winston 2006] explains that governments can fail "because markets are performing adequately or public policy does not correct a market failure efficiently", further stating that government intervention may even exacerbate a problem or entail (unintended) negative results and may result in "considerably greater" costs than the original market failure it was thought to encounter. "Dysfunction [of the effectiveness of democratic politics] is predicted because democratic institutions produce elements of irresponsibility and ignorance."[191] This is, because failures distorting markets (described above) can likewise happen to afflict governments, even burdened with additional aberrances (e.g. [Kashani

[187] [Global 500c]
[188] [Global 500b]
[189] In [Mercuro et al 1994], citing James E. Buchanan (1972)
[190] [Langford 1999]
[191] [Smith 2008], p. 1

2005] confirmed inefficiencies of the state intervention in the Norwegian Continental Shelf activities).

Generally speaking governmental interventions in markets that do not correct market failure, or even reduce the efficiency of allocation of good or resources (making society as a whole worse off, than without governmental intervention) are addressed as government failures.

"In short, government failures may be generated by non-Coasian legislative institutions, poor selection of policy makers, socially costly rent seeking, and intertemporal investment, policy, and political linkages." [192]

Observations of the **principal–agent theory** can help to explain failures as it describes combinations of parties where there is a principal delegating work to one or more agents to perform it, as for example in relation to civil servants within a ministry.[193] Since governments are structured hierarchically the development and execution of policies involve ministers delegating the preparation of detailed programs to lower level bureaucrats. But conflicting goals and asymmetry of information between the principal and the agent combined with the problem of control and assessment these constellations can cause agent opportunism: "bureaucrats may pay attention to their budgets and personal career advancement instead of the public services they are supposed to provide."[194] The information asymmetry problem may even lead to moral hazard problems. Overcoming the asymmetry of information problem costs of monitoring and valuation must be faced, but there are further solutions proposed by the agency theory according to [Ouyang 2006], namely selecting the right agents, using various forms of monitoring (such as third party control), and adopting various negative and positive sanctions.[195] Especially in policy processes involving high technology the information asymmetry problem is more severe, because of special technological expertise and know-how and may be subject to accelerated change and uncertainty (even hard to keep pace with for specialists) conceding significant leeway and power to agents (e.g. bureaucrats). To understand what makes states capable of efficient policy execution [Ouyang 2006] claims that "we must study the bureaucrats in order to understand the state's capacity and its role completely", because the "government leaders need to be able to control

[192] [Liu 2007], p. 1200
[193] See [Ouyang 2006], p. 1315
[194] [Ouyang 2006], p. 1316
[195] [Ouyang 2006], p. 1316 et seq.

their powerful bureaucrats when the bureaucrats are autonomous from the society"[196].

Public Choice Theory tries to explain the political processes by economic analysis of the "political decision making, including theories of the state, voting rules and voter behaviour, apathy, party politics, log rolling, bureaucratic choice, policy analysis and regulation"[197] and is based on the rational self-interest ('utility maximisers') assumption of all decision makers, introducing doubt about governments' (politicians') incentives to always act for the social good.[198]

Classical welfare theory suggests that all policy-decisions should be made with a view to the greatest utility available to the maximum number of individuals. This process of public policy making clearly involves trade offs. Public Choice Theory responds to observations that governments are not always only benevolently regulating markets for the good of citizens, but are also found to accommodate private interests, diverting resources to certain groups at the expense of citizens at large.[199] Besley is said to "point out the main trouble with the traditional welfare-economics approach when applied to policy making, i.e., the impossibility of providing a means of aggregating individual utility to form a societal measure of well-being".[200]

Sources of government failures according to Besley are "ignorance, private influence such as corruption and rent seeking, and the quality of leadership"[201] and the author will stick to this classification in the following, although it must be remarked, that there is no sharp separation possible since the human phenomena described in the following all interact with and fuel each other.

5.1. Information Failures

Information failures derive from asymmetric information situations between producers and consumers, which has been shown to lead to market failures, but also between the producers and governments leading to governmental failure.

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[196] [Ouyang 2006], p. 1326
[197] [Mercuro et al 1994], p. 172
[198] [Liu 2007], p. 1199
[199] Compare [Liu 2007], p. 1198
[200] [Liu 2007] (review on Timothy Besley's book "Principled Agents? The Political Economy of Good Government")
[201] In [Liu 2007], p. 1200

[Hillier 1994] describes the problem to be the following: "managers of the regulated companies know more about their companies than do the regulators"[202] and therefore recommends taking this into consideration when designing regulatory policy. Regulators may only have insight into external factors, having no knowledge about the production function (the exact cost functions of the regulated). As the tackling of environmental problems is very knowledge intensive and the measurement of externalities (also for positive) assessing their true worth is not an easy task, many instruments for governmental interference into environmental problems cause high administration costs (the government may have to hire information carriers at high wages in the fields of special expertise of highly technical industries). It is therefore important to consider the information structure between economic actors. Asymmetric information structures are set out in that there is more (complete) information on the one side than on the other (incomplete information).[203]

This is also a major distinctive feature from "uncertainty", where it is assumed, that uncertainty is the same to all market participants (simply for the fact, that science has not advanced to figuring out facts).[204]

These two terms used in economics but also game theory need to be distinguished in more detail:

Imperfect information – is when there is uncertainty about the actual behaviour of economic actors or if the evolution of circumstances is not known at decision making (no instantaneous update as soon as new information is available).[205] Imperfect information comprises the lack of knowing all prices (costs), values (benefits), long-term-effects and externalities and can therefore result in inefficient allocation by governments. Perfect information would only be possible at zero costs of information. It is therefore also for governments not a realistic status, because the gathering of sufficient information is no easier for the regulator than for the individual.

Incomplete information – is when the economic actors do not know all elements defining the rules of the process itself (e.g. how many actors taking part).[206] This lack of information can lead to unforeseen consequences.

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[202] [Hillier 1994], p. 139
[203] See [Phlips 1988], p. 2
[204] See [Phlips 1988], p. 3
[205] See [Phlips 1988], p. 9
[206] See [Phlips 1988], p. 9

There is the general assumption in economic theory that individuals prefer levels of better information to inferior levels if there are no transaction costs. Therefore models tend to display the optimal level of information to be only stemmed by the costs of information: costs of searching, transmitting, acquisition (depending on the information technology) of information and then the costs of transformation (of information into knowledge) also influenced by the a priori knowledge. Clearly hereby time plays a crucial role, with increasing value, the more educated individuals need to occupy.[207]

But this general view of theory is opposed by practical findings of human nature taken from psychology regarding the assumption that new information is always used to reconsider viewpoints – the theory of **"Cognitive Dissonance"** suggests following findings, that have been shown by experiments: it suggests that people have preferences over their beliefs about the state of the world (just as they have preferences over the real state of the world), they can control their own beliefs (by selecting "credible" information sources and choosing sources that are likely to conform with their "desired" beliefs) and further tend to stay with chosen beliefs.[208]

Also there is the constraint of **Rational Ignorance** that describes actual "rational" behaviour, if the cost described above involved with the gathering of sufficient information and learning (on a certain issue in order to make an informed decision) is judged to outweigh the expected potential benefit. Spending time and money on informing oneself can therefore be set aside due to considering it as irrational and not all the information necessary to make an informed decision on issues will be retrieved. The problem of rational ignorance yet again can be a variant of the public goods problem. This is because time spent gathering information by governments could be worthwhile if better decisions could be conveyed to the public as a whole.

[Turner et al 2000] have found that policy intervention failures (along with the public good and externality problems) "due to a lack of consistency among government policies in different areas (economics, environment, nature protection, physical planning, etc.)" have led to the loss (and threatening) of wetlands all over the world. The group of scientists traced back the reasons of (all (!) the facets of the wetlands-extinction-problem) to **information failures**:

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[207] [Phlips 1988], p. 12 and 23
[208] [Phlips 1988], p. 12: citing Akerlof and Dickens 1982, p. 307

complexity and 'invisibility' of spatial relationships in the ecosystem. As a solution integrated research (combining social and natural sciences) are recommended to partly solve this failure by achieving the required consistency across various policy fields.[209]

Another problem can simply be the idled perception of action-requirement caused by either lack of knowledge on action-requirement (incomplete knowledge, different to information!) concerning a certain existing environmental problem. As perceiving environmental problems is often linked to high information demand (or better: knowledge of certain interaction has to be understood), they often are not avoided ex ante, but only at their occurrence. It for example needed a severe fish-die-off until the quality of rivers diminished in such an obvious way that governments began to monitor and draft regulation.

However, provision failures can occur even although an environmental problem is obvious, if there is insufficient public demand of action (causing minor priority of the issue) resulting in ignorance by politicians until a certain level of public demand gives a reason to act (being worth the effort by taking credit for tackling the problem). This can also be seen from the point that politicians are influenced by lobby groups and can only resist the pressure, if there is enough public opposition justifying reluctance.

5.2. Individualism

Governments may not always pursue a clear objective to reach this social optimum because of discrepancies on approaches (how to tackle problems) and internal power struggling (democratic lock-up) between political parties (being a political playing field for personal interests of politicians and not public interests), resulting in a weakened, antagonistic position to resist lobbying and counteract market failures. [Shaffer 1995] brings up the paradigm of "interest group pluralism" theorizing "that the public policy process attempts to reach compromise between the competing goals of a multitude of interest groups" and states that this democratic process is doubted (by political scientists) to function effectively.[210] When governments are subject to influence from organized groups, they become tools through which benefits are channelled towards the interest of these groups.

[209] [Turner et al 2000]
[210] [Shaffer 1995], p. 499 et seq.

Further the nature of environmental polices interacting and correlating heavily with other political resorts, as for example the building of streets by the infrastructure authority, entails the problem that aims are often not harmonized and work against each other.

Additionally governments might not be as benign, as it could be hoped for. This can range from the complete lack of will or a weak incentive to serve the community (a factor closely linked to the existence of free elections), to the selective representation of interests of certain favoured societal groups, meaning the governments "may well not act to protect the environment, especially if they think, that environmental protection will impose costs on members of powerful pressure groups."[211] "Even in democratic countries governments may to have to please a certain pressure group rather than the community as a whole."[212]

Further, lacking diligence, because other preconditions are not fulfilled e.g. citizens monitoring the government's activities, voters taking the time to study issues prior to voting, experts generating socially beneficial policy ideas, which are implemented in the correct situations and ways, etc.[213] - many of these preconditions, however, being public goods themselves. By the logic of public goods theory, these preconditions will not be sufficiently provided on the market, so some of the necessary preconditions for government to provide public goods will not be met.

5.2.1. Rent-Seeking

Rent seeking occurs where decisions are manipulated to be made in favour of certain individuals or interest groups (being either regulators, bureaucrats or regulated) leading to resource allocation profitable for the rent seeker at the expense of others. Rent seekers try to draw (uncompensated) advantages (rents) from regulation (processes) and law, manipulating the impact of regulations, rather than creating profit by economic actions (production, trade): legislators try to ensure re-election, bureaucrats try to increase their influence and budget (to promote own interest), the regulated try to increase subsidization to obtain and/or reduce competition.

[211] [Turner et al 1994], p. 80
[212] [Turner et al 1994], p. 80
[213] [Insua et al 2007]

The impact of rent seeking can be considerable, if "buying" a favourable regulatory environment is cheaper than more efficient production: resources are spent on lobbying that is unrelated to contributions to social wealth or well-being.

An example of rent seeking would be lobbying for economic regulation of tariff protection by the agricultural lobby.

5.2.2. Regulatory Capture

Rent seeking, information failures (above all rational ignorance), which have been described above, are the main mechanisms, which allow Regulatory Capture to happen. Regulatory Capture is an economic phenomenon, following the observation of collusion between firms and the government agencies that are actually assigned to regulate them, especially when there is asymmetric information between the regulator and the regulated.

[Laffont et al 1991] explain that "[t]he "capture" or "interest group" theory emphasizes the role of interest groups in the formation of public policy" and state that it strikes roots back to the view of Marx (inter alia) that big businesses control institutions. [Laffont et al 1991] also cite Stigler, who noted, that the "regulatory process can be captured by small business industries as well […]"[214].

The phenomenon of "regulatory capture" is about the capture of regulators by the regulated and encompasses active but also passive behaviour by responsible authorities resulting in protection of illegal, unethical, immoral or anti-public interest practices that respective authorities are actually charged with to regulate.[215] The to be regulated industry gets so many "friendly votes" from the regulators, that their utilities are the driving factor and these industries actually control regulation: the regulator becomes dominated by the interests of the industry that it is supposed to monitor.

[McMahon 2002] claims that "there is no bastion of morality or courage or vigilance or statesmanship or ethics that seems immune from the threat of 'capture'"[216] and concludes that the phenomenon is not fully visible (not even for courts). Further [McMahon 2002] provides a classification of certain levels of capture:

[214] [Laffont et al 1991], p. 1089
[215] [McMahon 2002], p. 3
[216] [McMahon 2002], p. 3

1. Regulatory Capture may start with the regulator allowing a certain group or individual that should be regulated "to breach the law, ethic, good practice rule, moral principal or public interest duty that the regulator is responsible for upholding."

2. The next level involves the regulator assisting "the regulated to avoid the regulatory consequences after the fact."

3. At the "deepest level of development, the 'capture' is so complete that the regulator may assist the regulated to defeat the regulatory regime before the fact."[217]

Two **main causes** of Regulatory Capture named in literature can either result from subordination of an entire regulatory system to the regulated industry (a so-called "systemic capture"), but also from undue influencing (through personnel exchange, identification with values through frequent contact, direct corruption, etc.).[218] Hence, designing regulation "needs to take account of regulatory capture", which is recommended by Mc Mahon to be achieved best by "[m]arket-based instruments and independent regulatory bodies tend to reduce the scope for capture."[219]

[Laffont et al 1991] puts forward an interesting claim, that contrasting "conventional wisdom of interest-group politics, an interest group may be hurt by its own power".[220]

5.2.3. Logrolling

Logrolling is about trading votes by legislative members due to a specific purpose, or even buying/selling votes and can involve not only individuals, but also whole interest groups or parties.[221] The implicit bargain is the expectation of cooperation regarding decisions on resource allocation in return for support in other decisions, resulting in actual power not being exercised (otherwise there will be retaliation). In order to reach the two main goals of politicians (re-election and passing certain policies[222]) logrolling can be used to increase the chance of passing bills.

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[217] [McMahon 2002], p. 1
[218] [McMahon 2002], p. 10
[219] [Helm 2006]
[220] [Laffont et al 1991], p. 1117
[221] See [de Carvalho 2006], p. 869 et seq.
[222] In order to be reelected?!

In his paper [de Carvalho 2006] showed, that "the lack of a stable government coalition resulted in costs to society that were not anticipated by the government".[223]

The government used logrolling (a trade of votes) to "guarantee the number of votes necessary to approve the amendments", creating "a vicious system in which representatives would only vote with the government if they had benefits in return".[224] A basic remedy for logrolling is requiring supermajorities.

5.2.4. Pork Barrel Politics

The term (smoked pork was in earlier times transported in barrels) derives from the U.S. where politicians would enrich their voters by government spending to their advantage, but burdened on all tax payers.

This deficiency of policy processes therefore contributes significantly to government failures, because of limiting economic efficiency, wasting resources and reducing welfare impacts. A reason for pork barrel spending may well be the "electoral pressure": politicians striving for re-election need to pass 'popular' policies to capture votes.

5.3. Deficient Quality of Leadership

[Lodge 2002] finds that "[r]egulatory reform is often seen as a road paved by good intentions", nevertheless it can lead to "policy hell", as [Lodge 2002] calls it. Hence, it is not enough to have good intentions, because there is another possible source of government failure: the intellectual capacity of the decision maker itself in charge for developing and implementing a policy. If the basic quality of leadership, competency, is missing, policy makers can cause government failures. But competency does not prevent the politician from committing government failure "by implementing projects harmful to society by following personal preferences"[225] (as shown above). It can therefore be seen as an additional prerequisite for a functioning regulatory system. The qualities of regulators may not only encompass technical, bureaucratic and other specialist knowledge, but also the cooperation ability: [Peterson et al 2003] claims, that the real regulatory

[223] [de Carvalho 2006], p. 865
[224] [de Carvalho 2006], p. 865
[225] as [Liu 2007], p. 1200 gathers.

failure of the Californian Electricity Crisis has been "that FERC[226] and state policymakers were unable to work together to resolve the crisis."

Mismanagement, miscalculation or other errors can cause a **regulation failure** that occurs, when regulation designed to avoid (also only potential) market failures, results in decreased economic welfare e.g. because administrative costs outweigh the benefits of regulation.

Likewise [Jaffe et al 2005] argue that "the rate and direction of technological advance is influenced by market and regulatory incentives, and can be cost-effectively harnessed through the use of economic-incentive based policy" but warn that "[I]n the presence of weak or nonexistent environmental policies, investments in the development and diffusion of new environmentally beneficial technologies are very likely to be less than would be socially desirable."[227] Environmental policy therefore needs **strong advocates** that are not easily misled by the discussed governmental failures to overcome the present status of regulations being subject to the toxic mix of public hysteria, rent-seeking of lobbyists, and power-seeking by bureaucrats.

In this respect the author wants to make the following statement: ''environmental policy is the prisoner of all other policies of social and economic affairs, to which higher priority is given''.[228]

5.4. Consequences of Government Failures

[Winston 2006] claims that "[g]overnment failure may result in missed opportunities, wasted resources, and waning public support".

5.4.1. Welfare Impacts

Due to absence of adequate information and/or information aggregation problems in the political process, government decisions may ignore to measure valuations of individuals regarding public goods accurately, but also may fail to distribute these fairly (according to certain welfare criteria).

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[226] FERC = U.S. Federal Energy Regulatory Commission

[227] [Jaffe et al 2005]

[228] [Kronenberg 2007] subciting on: van der Straaten J, Ugelow J. Environmental policy in the Netherlands: change and effectiveness. In: Wintle M, Reeve R, editors. Rhetoric and reality in environmental policy. Aldershot, UK and Brookfield, US: Ashgate; 1994.

Rent seeking, logrolling, pork barrel spending activities may have different welfare effects depending on the situation for the whole society before and after these decisions, such as the erosion of consumer surplus but also producer surplus.

5.4.2. Market Distortion

Implementation of instruments without profound knowledge of market mechanisms can distort the market (e.g. setting taxes the elasticity of demand must be known accurately): agricultural subsidies, fuel taxes can lead to suboptimal allocation of goods and services (if applied in the wrong amount). Further markets are e.g. distorted by the effect of "crowding out" resulting from extended governmental spending (e.g. to finance subsidies) causing the rise of interest rates, putting pressure on private sector investment. "As policy makers misread economic theory, they produce results worse than those they are attempting to correct. Thus, these distorting effects are equally as bad, or worse than, the market failure regulators hoped to ameliorate."[229] Also Regulatory Risk (being the risk faced by firms due to regulatory changes) is distorting markets.

5.4.3. Short Termism

[Pineau 2007] establishes a policy analysis framework that allows the evaluation of the likeliness that the implemented policies are sustainable and gathers "policies based on a flawed analysis are unlikely to produce outcomes that are sustainable in the long run."[230]

Besley's model is also stated to reveal that the "government's inability to commit to a policy ahead of time can reduce welfare" and that "re-election prospects shape political incentives and lead to the choice of inefficient policies".

Hence there are indicators that the orientation at election cycles (short time horizons of a couple of years only) lead to the putting on hold of complex long-term issues.

5.4.4. Unintended Consequences

Wrong decisions can lead to disincentive effects, misallocation of resources (again lowering social welfare). As a consequence of incomplete information regulators'

[229] [Alleman et al 2007]
[230] [Pineau 2007], p. 166

actions might entail consequences that they have not intended, but still occur, because of the adaptation mechanisms of the market (mostly resulting out of substitutional behaviour).

5.5. Possibilities to Avoid Governmental Failures

Therefore, even if government interferes, an adequate provision of public goods is not guaranteed to be reached. Moreover for the reason that finding solutions are not open to private actors countering government failure offers more limited options (compared to market failures). In [Mason 2008] Ann Florini gives a definition of governance transparency: "the degree to which information is available to outsiders that enables them to have informed voice in decisions and/or to assess the decisions made by insiders"[231]. It is argued that transparency as a moral and political imperative is clear to states having developed right-to-know legislation, however noting that some developing countries "have been more ambitious than the older Western democracies in the scope of their information access entitlements"[232].

[Kathuria 2007] outlines that due to the limitations of formal regulations that have been recognized combating pollution in developing countries "there is a growing interest in the potential of informal regulations to achieve environmental goals"[233]. Perceiving chances for "informal channels" or local press to influence local pollution in India, the study shows that the press can function as an informal agent of pollution control. However there is not immediate effect, but only if there is sustained[234] interest about pollution and suggests that "lobbying efforts through the media by environmental activists and NGOs may be quite effective in influencing industry behaviour"[235].

Also Mildred Warner is stated to recognize the extensive failures that characterize markets and governmental interference, yet stating that governments play "a market structuring role in building competition, managing monopoly and reducing transaction costs of contracting"[236]. This governmental role is addressed as necessary and desirable by her because it holds out both efficiency and planning benefits, but she is stated to call "for the inclusion of civic groups in the design

[231] [Mason 2008], p. 9
[232] [Mason 2008], p. 9
[233] [Kathuria 2007], p. 403
[234] [Kathuria 2007], p. 403 et seq.
[235] [Kathuria 2007], p. 415
[236] [Ramesh 2008], p. 1 et seq.

and delivery of public services"[237] because she is convinced that "public engagement can help mitigate government and market failures and foster solutions to difficult public problems that are both efficient and socially optimal."[238]

6. Instruments of Power of the Economy

[Grey et al 1993] have analysed the impact of regulation on the economy, by examining the interrelation of productivity growth and environmental regulation on three manufacturing industries in the time interval 1979-1985 by calculating both labour productivity and total factor productivity over time and relating these values to the pollution abatement expenditures, comparing the changes of growth rates to pollution abatements costs (weighed by other factors as compliance status, pollution level etc.). The results show that "[p]lants with higher compliance costs have significantly lower productivity levels and slower productivity growth rates than less regulated plants"[239]. The study reveals a total factor productivity reduction by a 3 to 4 fold of a compliance costs increase.[240]

From this starting point it is clear that firms' individualistic behaviour will try to oppose and manipulate the magnitude of "burden" shifted onto its economic stance. Responses of firms to environmental regulation include strategic adaptation but also attempts to influence policy-makers.[241] To reflect on how far companies can push their interests [Gunningham et al 2003] draw up the theory of companies acting within the realms of a so-called "license to operate" (due to their research work on corporate environmental behaviour of paper mills) consisting not only of a

- Regulatory license (e.g. land use permits, process standards), but also of an
- Economic license (e.g. creating return on investment and profit growth, liquidity constraints) and a
- Social license (e.g. meeting demands of social actors, such as neighbours, environmentally concerned NGO's, functioning as part of the social system[242]).

[237] [Ramesh 2008], p. 1 et seq.
[238] [Ramesh 2008], p. 1 et seq.
[239] [Grey et al 1993], p. 2
[240] [Grey et al 1993], p. 16
[241] [Shaffer 1995], p. 495
[242] This view is also shared by [Shaffer 1995]

These aspects of the "license to operate" interact and can leverage each other: companies that are not taking over responsibility for their social license (pushing it too far) risk future increasing stringency of the regulatory license as they provoke environmentalists to engage in lobbying at governmental level or might call for a consumer boycott influencing the economic license. On the whole the economic license can be seen to operate "as a brake on beyond-compliance investments and expenditures"[243] with governmental interference determining companies' profitability by certain grades (according to the situation and the instrument used). According to the severity of interfering with a company's (estimated) capabilities to achieve profits, the following instruments can be installed to improve the economic situation.

6.1. Using Public Relations

Businesses can choose to face environmental issues in their interaction and communication with their customers (according to the degree of public interest). As it is stated that "social license pressures have intensified"[244] especially industries producing consumer goods will have to evidence more and more the ecological friendliness of their production methods and the resulting product for sale. Revealing environmentally related information may be enforced (e.g. CO2 emissions of cars), but can also result from a foresighted strategy of responding to a customer having further needs and expectations on top of merely focusing on factors such as price, look, etc. Some businesses and business organisations have recognized the importance of the implementation of the environmental "view" and support their state's environmental initiatives.

The Balanced Scorecard (BSC) for example is a multidimensional evaluation system (from the domain of Business Intelligence) concerning several views on the situation of the business apart from the financial view[245], deploying a holistic view on the business opportunities that can be amplified depending on the individual business e.g. customer and employee perspective, process-perspective, development/potentials perspective and ecological perspective: in [BMFVIT] it is shown that the Austrian Federal Forests[246] use such an expanded (in respect to

[243] [Gunningham et al 2003], p. 36 et seq.
[244] [Gunningham et al 2003], p. 44
[245] This has been has always met with criticism because it leaves out on other factors completely, which are also significant for decision-making processes.
[246] Original term in German: "Österreichische Bundesforste"

the classical) BSC to encompass further strategic control components building up consistency in all company domains.

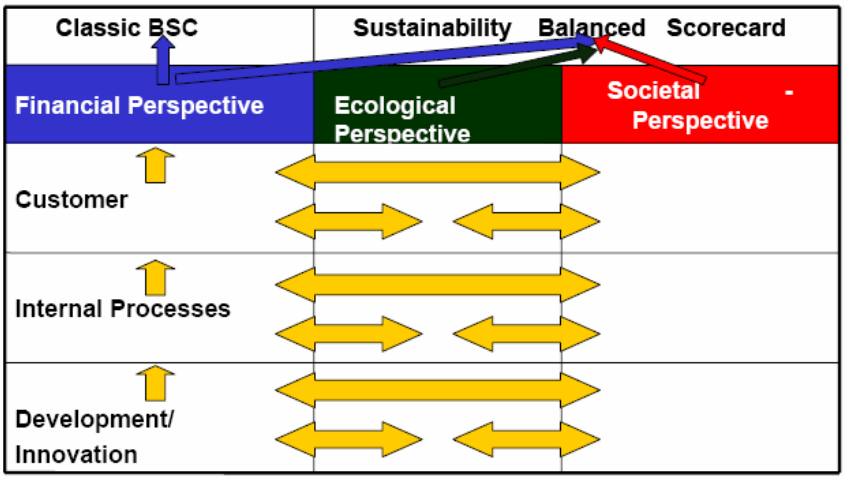

Figure 2: Sustainability Balance Score Card; Source [BMFVIT], p. 20

"Regulative leaders" have significant opportunities to improve their social license by moving beyond meeting minimum environmental requirements and responding directly to community concerns. Maybe firms (environmental) PR can be seen as some kind of preventative measure, a possibilities of companies to react to and manage their individual business environment by paying attention to the social license of a company.

Public Relations include the active communication transporting information across available media (internet, newspaper, hotline etc.) on environmental concerns such as for example by the regular issuing of environmental reports observed by a number of companies, especially in the heavy polluting sectors, such as chemicals (company BASF), petrol (company BP)) but also the engagement in the European Environmental Management and Auditing Scheme (EMAS) and ISO-certifications (ISO 14001 certified environmental management system) constituting possible responses to the stakeholders' demands. As e.g. a social health reform was planned in 2008 in Austria limiting certain rights of medical doctors an advertising campaign was started opposing the arguments drawn up by the state and directly communicating with their direct stakeholder, the patients, as an act of political resistance. It could be considered that similar action can be taken by other economic players concerning environmental regulation, in cases of governmental failure.

However, businesses can convert additional costs into added value and additional selling propositions (even bearing the possibility of gaining a comparative corporate advantage) by creating a consumer surplus through environmentally sensible behaviour. But of course this economic process of "rent-seeking" can also aim at gaining competitive advantages "by influencing legislative and regulatory processes rather than through competition in product markets"[247] seeking to obtain advantages by resistance or opposition to regulatory processes.

6.2. Lobbying, (Il)legal Platforms, Cartels, Unions

While the main response on firm level is adaptation[248], attempts to influence the development of environmental policies can be undertaken by bundled interest groups, seeking to protect and advance their interests by lobbying or building coalitions that try to influence political developments. Thus efforts are typically targeted at governmental authorities: interest groups can either lobby directly e.g. national governments or indirectly e.g. members of the European Council working groups. If lobbying performed on behalf of organisations includes making contributions, the borderline to corruption is blurred, especially if politicians then appear to be acting upon the lobbied interests. Lobbying in the EC came up in the late 1970s, but at that time only a few lobbyists were involved in the system and likewise only a few business associations upheld representative offices. But the more legislative power was bundled in Brussels the more companies started to open offices in order to be nearer to the source of change needing to be provided with updated information, but also trying to influence the process actively and effectively. The more complex EU legislation evolved and the mightier the EC grew the more important and attractive lobbying has turned out to be for all different kinds of stakeholders. Currently around 15,000 lobbyists[249] (consultants, lawyers, associations, corporations, NGOs, international organisations, trade federations etc.) are stated to be in Brussels. More than 2,600 special interest groups (the number growing) have a permanent office in Brussels, displaying the importance of lobbying work and the tendency of efforts to directly influence the political agenda at European level. The EC and several European governments are

[247] [Shaffer 1995], p. 500
[248] [Shaffer 1995], p. 498
[249] The only source the author could retrieved actual numbers from was [Wikipedia 01] and despite the unacademic character of the source, this data was still judged interesting by the author.

claimed by the WTO to have worked closely together with business lobbies such as the European Services Forum.[250]

The outcome of lobbying can be seen according to following example stated by [Lee 2008]: "In Korea, it is highly probable that the contribution of environmental regulations to productivity growth varies across industries depending upon the degree of market power; industries with more market power have less regulatory impact."[251]

Not in an environmental area, but still exploring the political economy of the regulatory process [Duso 2002] has empirically investigated the U.S. mobile telecommunication market in the 80ies and revealed that businesses could influence the choice of the regulatory system by lobbying, resulting in regulation moving towards the set goals, however not very significantly. [Duso 2002] found that some companies plied such a successful lobbying, that markets were not regulated where it would have been most efficient. [Duso 2002] furthermore finds that the smaller the companies' opportunities for collusive behaviour on the market (enabling the aiming for coordinated goals) are the higher lobbying efforts will be.

[Duso 2002] states that "[r]egulation, like many other policy decisions, results out of a complex process that is shaped by political as well as economic forces. Therefore, regulatory decisions must be endogenized when studying their impact on the market outcome." It can be assumed that environmental regulation faces the same problems.

Economic Chambers

Federal Economic Chambers are (in best case) democratically self-governing bodies that are financially independent to governmental authorities by the grade of funding by its members.[252] Economic Chambers act as coordinated representatives of the interests of business and balance sector and size-related interests. Since these institutions bundle the interests of entire business communities they play a role as an intermediary (also building central contact platforms for companies) coordinating and representing economic interests at

[250] [WTO 07]
[251] [Lee 2008], p. 5
[252] The Austrian Federal Economic Chamber is financially self-supporting with around 85% of expenditure covered by member contributions and a further 15% by revenues from marketable sales.

national and international level (offering information on law issues, organizing industry-wide advertising and market research, collective bargaining, training and consulting). Membership can be compulsory (as e.g. in Austria) and governments can be obliged to involve the relevant economic chamber in decision-making and administrative procedures, i.e the Austrian government is obliged to consult the Austrian Economic Chamber on legislative projects and important regulations.[253]

Trade Organisations

Trade organisations support and promote businesses involved with international trade by consulting and guiding enterprises worldwide helping companies to find suitable foreign business partners and strengthen existing business connections, improving the ability to compete in the global marketplace. In Austria e.g. this service is provided by a specialised department at national level ("Austrian Trade") and by offices in new high-potential markets.[254]

Professional Associations

Professional Associations (or Industrial Unions) can cover all kinds of different sectors throughout the industrial landscape of a country (producing, processing, servicing industry) and help bundling interests. Membership, normally on a voluntary basis, opens up the access to a lobby group upholding relations with politicians and opinion leaders, maintaining a network of contacts to permanently represent the interests of its members on national but also international levels.

6.3. Threat and Intimidation

Threats can reach from the outsourcing of company-parts or even moving the whole company to a country with a laxer environmental law, to the threat of loosing working places, liquidity problems leading to a possible bankruptcy of the company. Further multinational companies can "think loudly" about their requirements or constraints regarding a possible FDI in the planning phase of new facilities or regarding the considerations of closing a site.

The evaluation of these threats can be seen in their possible consequence for a society, so as the moving of a company causes loss of income to certain societal groups, but also results in income tax losses for the respective government.

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[253] [WKO 01]; [WKO 02]
[254] [WKO 02]

Whereas the macroeconomic impact of e.g. a huge pharmaceutical company shutting down can clearly be estimated in terms of high-class working places lost, decreased income tax flows and even possible unemployment insurance payments, loss of the economic status of the region, etc. are obvious and can be calculated on a rather short notice; with environmental impacts on the other hand the costs are hidden and can be subject to information which is very hard to obtain (as for example the willingness to pay, which is often biased) on a huge scope (the society). Clearly it is sometimes tempting to make concessions regarding intangibles, rather than letting a good chance to create material wealth slip away.

6.4. Choice of Location

As the strongest instrument of power of last resort the moving of (existing) locations and the decision against a certain location can be the adequate strategy respond of firms in regard to un-negotiable environmental stringency.

Constraints Of Free Choice Of Location

There are limitations to the possibility of moving whole production sites:

- Firms engaged in certain activities bound to a local extraction of a good (mining, fruit growing),
- Service companies clearly must be based at the customer (tires can be produced somewhere else, but the can only be sold and mounted at the customers site).
- Further perishable goods (e.g. bread) tend to be produced near the customer (depending on whether the profit margin allows for the costs of long distance transport further influenced by weight, size and durability of products).
- Heavy industries with a high quota of fixed installations and equipment, such as the company VOEST Alpine will find it rather difficult to move on short notice. But how long will VOEST Alpine stay under conditions far more stringent than in other countries?

However, there are some constraints onto the solemn choice of location according to low levels of environmental protection. Today’s economic map of the world is

dominated by what [Porter 1998][255]calls clusters[256] defined as unusual accumulation of competitive success (regarding a specific field of economic value-adding) in a location (national, regional, state and even metropolitan economy), especially in more economically advanced nations. These clusters are not unique, but highly typical, promoting both competition and cooperation: according to Porter the enduring competitive advantages in a global economy lie increasingly in local knowledge, relationships, motivation, that distant rivals cannot match. Clusters increase productivity of companies based in the area, driving the direction and pace of innovation (important to sustain future productivity growth) and stimulates the formation of new businesses[257]. A cluster allows each member to benefit as if it had a greater scale[258] or as if it had joined with others formally, without requiring it to sacrifice its flexibility, with the linkages among the members leading to better results. Summarizing the choice of location can be influenced by considerations on the allocation of competitive clusters. However there are many other business environment factors, such as supplier structure, market and price development, legal issues (tax law, legal security, social law) that determine the choice of location of companies.[259] Also internal business analysis (e.g. on the necessity of skilled labour bound to the original location) can also play a role hindering free moving of location. Seen from the imposed costs that have to be faced on moving, there are transaction costs (finding/choosing location with less stringent environmental regulation, negotiation with employees made the proposition to be "exported", changes in suppliers and logistics), transportation costs (equipment) and risks (lack of knowledge on the foreign market, knowledge loss by employees not willing to emigrate, uncertainty on the period of the environmental law advantage). Generally moving will only be dominant strategy if costs for moving are perceived to be smaller than the environmental regulation costs imposed on a firm.

If the same standards apply in all MS of the EC, a company would have to move completely outside the European territory. IMHO it is a sticking point to move on with the closing of ranks of European countries (forming a great part of

[255] [Porter 1998], p. 77-90, on which the assumptions of the following paragraph are based.

[256] Example tourism in Italy: strong reputation for design and shoes, joint marketing mechanisms.

[257] because of the concentration there is lower risk, market opportunities be spotted more easily and barriers to entry are low (needed assets, skills, etc. are available)

[258] The cluster-members results are on the whole greater than the sum of its parts. The wealth of the whole Cluster is greater than each company's created wealth alone.

[259] See e.g. [Lechner et al 2003], p. 96

industrialized countries), because promoting environmental law development on supranational level diminishes avoidance-opportunities for companies.

7. Results and Conclusion

As [Revesz et al 2007] put it: "Of course, no particular form of government intervention, no individual policy instrument — whether market-based or conventional — and no specific level of government is appropriate for all environmental problems. Which instrument or level of government is best in any given situation depends upon a variety of characteristics of the environmental problem, and the social, political, and economic context in which it is being regulated."[260]

The role of governments is to integrate the consideration of risks and impacts on the environment in the set of managerial decision-making-processes. The most diligent way however is not to take over this decision-making-process for those assigned with the tasks in the businesses, because the law-maker is rather not capable of competing with all the different scientific capacities working for industries in the economy, but carefully lead these institutions onto a sustainable path. Administrative, managerial and technical competence capacities should not be overruled by (unskilled) top-down-regulation not considering all impacts, as can the specialists (both technical and managerial) in the respective industries, which of course for their part may be reluctant to provide or bias this information.

Besides the problems caused by this information asymmetry, environmental policy is also restricted by the fact, that the national labyrinth of incentives and constraints aiming for certain purposes of either social, economic or political kind include many initiatives that are not based on the idea of sustainability (subsidizing the building of streets, watering systems, forest-clearing licences[261] or even the use of pesticides[262]). To extinguish the incentives actually destroying the environment therefore is to be assumed an integral part of sustainability and is why governments have to set their clear aims in environmental protection and then take the necessary steps, withstanding displayed counter-pressures of the regulated economic players and resisting discussed governmental failures (e.g. regulatory capture). The author can therefore only agree with [Bøgelund 2007]

[260] [Revesz et al 2007], p. 63

[261] Many developing countries having debts, offer tax advantages or other financial incentives in order to attract international investors to convert forests into grazing land.

[262] For example [Brown et al 1992], p. 136 claims that Egypt's fiscal spending for subsidies on pesticides in 1982 was higher than the budget for health care.

stating that "we need more research into the institutional setting of the policy-making process"[263] to succeed in the challenge of making environmental concerns matter in those policy processes, which at the moment "fail to take environmental concerns into account in a proper way". [Bøgelund 2007] even argues that "government alone cannot provide the basis for making informed decisions about environment and development" because they "tend to let other more traditional and narrow economic concerns dominate decision-making"[264], and is why the work of NGOs is crucial to the forthcomings of environmental law.

Environmental policy has to become smarter to ensure environmental protection balances conflicting demands efficiently and effectively through the appropriate use of risk-based approaches, greater standardization and associated charging mechanisms, environmental taxes, trading schemes, negotiated or voluntary agreements, advice and education programs, environmental management systems.[265] Furthermore it is crucial to not only produce environmental legislation but also actually effectively implement it, e.g. by introducing incentives (for ecological behaviour) or certain factors of deterrence (to avert environmental polluting activities) for economic actors.

As outlined in the paper social optimum of the environmental state is where marginal cost of environmental degradation equals the marginal benefit of pollution. The marginal costs of one more unit of degradation can be understood to be the "sum of the maximum that each member of society is willing to pay" for avoiding that unit. But measuring and calculating true social costs of certain economic activities is highly sophisticated, requiring much expert knowledge (that can be biased), interdependent, includes vague estimates on risks taken and throws up the difficulties of calculating the impacts on the quality of life and assigning a value to these impacts. Therefore "[a]s a result, society often under-estimates the true marginal costs of society".[266] Governmental decision processes to practical problems therefore need to diligently estimate benefits and costs to society as a whole, aided by social cost-benefit-analyses, trying to incorporate as many aspects as possible, also accounting for intangibles invisible as direct expenses.[267] The case study of this paper will provide an example.

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[263] [Bøgelund 2007], p. 78
[264] [Bøgelund 2007], p. 79
[265] see [EA UK]
[266] [Krugman et al 2008], p. 471
[267] [Krugman et al 2008], p. 499

8. Critique, Outlook, Final Remarks

Literature Gap

The author has experienced a severe literature gap in academic journals on the issue of firms' responses to environmental policy. There were only a handful of articles found to include some information on how businesses oppose the development of more stringent environmental law. Many kinds of combinations of catchwords have been used (firms, companies, economic (system), sector, industry, business, economy; resistance, opposition, negotiation, power (instruments)/ influence, interaction, interdependencies, reluctance, resistance, evasion, avoidance, effect / governmental, environmental regulation, law, policy etc.), however it must be stated, that only articles being available free of charge (retrieved through the University of Vienna user-login) were reviewed. Also Internet searches would not lead to desired inputs. In times of increased CSR literature the author has experienced that these are full with success stories (firms proudly claiming how well they perform regarding environmental concerns), but that there is only little (academic) information on the downsides. Although economic pressure certainly existent and are reported by newspapers or other media, academic research seems not to have interfered with the interactions of environmental law and the opposing power of economy. The statement of [Schaffer 1995] still seems to hold:

"Scholars interested in business political activity are to a large extent fragmented by their disciplinary loyalties. As a consequence, research in the general area of business political behavior has proceeded unevenly, and is characterized by a lack of theoretical and methodological cohesion. […] This convergence suggests the potential for improved integration of theories from different fields and perspectives, a goal to which this study attempts to contribute."[268]

The author therefore hopes that future academic research will focus more on these crucial interdependencies in order to better understand the mechanisms and indicate remedies for the social good.

At least the author has found that other authors (in a similar research field) have been facing the same problem, e.g. [Fullerton et al 2007]: "Regulations that restrict pollution by firms also affect decisions about use of labour and capital.

[268] [Shaffer 1995], p. 497

They thus affect relative factor prices, total production, and output prices. For non-revenue-raising environmental mandates, what are the general equilibrium impacts on the wage, the return to capital, and relative output prices? **Perhaps surprisingly, we cannot find any existing analytical literature addressing that question."**[269]

Outlook and Final Personal Remarks

Science will have to focus on filling the gaps in literature explained above. Academic research is needed to uncover costs, originating from (economic) activities, resulting from intangible consequences still lacking our attention. Conclusions will help gradually understanding the complex scientific aspects and interactions of environmental problems and their possible physical, economic and social effects. Adjusting values (costs) to the various forms of environmental degradation is necessary to aid governmental decision making processes: governmental interference needs guidance by social cost benefit analyses to identify the optimum level of environmental protection balancing the costs imposed on regulated economies against the estimate of damage of caused externalities. Environmental accountancy and the come-back of factual discussions in politics coupled with public awareness may disentangle the problem of enforcing viable environmental law. Overcoming humane tendencies to procrastinate tackling problems, rigorous and prudent steering towards a sustainable pathway is necessary for future human existence. The biggest challenges of our time, global climate change, will hopefully develop to be a trigger for appropriate international environmental law: a global solution for global problems. Despite all constructive enthusiasm and the recognition of international environmental problems (such as "global warming"), appropriate international law and enforcing institutions still fail to exist. Concerning the progress of international scope of environmental law, the fusion of countries as within the EU helps to achieve goals, which single states could not aim for since businesses face a greater barrier of possibilities to overcome these regulations by intimidation (e.g. with the threat of migration to a neighbouring country). Businesses wishing to bypass the stringency of environmental law conditions are therefore encountering higher inhibition thresholds, because needing to move outside the EU, helping to diminish the race to the bottom by counteracting

[269] Emphasis by the author

pressures from businesses to "lower" compliance levels to environmental regulations.

Despite the increased direct costs and other efforts entailed with the implementation of environmental principles in the economy, a change of environmental performance is also linked to benefits in the long run[270]: since it anticipates an adjustment to a changing business environment as environmental regulations are becoming tougher on the whole, the return on investment of sustainable production methods might not be as high, but more secure in terms of financial risk. Following the evolution theory of organisational theory, over time only those companies survive which follow the best strategy to adjust to market exigencies. The implications through changes of the world climate and the consequences of environmental pollution on human health will be the next bottle neck to sort out, those being adaptive to future, new requirements. "The economy gains its legitimacy through meeting the needs of society, and increasingly society (due to the worsening environment and living conditions) is expressing a clear need for more environmentally sustainable practices".[271] Therefore, in the long run businesses will have to follow sustainable business practices. If all business activities take full social costs into account at their strategical planning and throughout their operations, the adoption of sustainable production and consumption practices will be the norm. Environmental protection needs to be considered as an integral part of the development process and environmental risks associated with human activities have to be assessed.[272] Products should be designed, marketed and licensed to minimise environmental costs in manufacturing, usage and also in terms of end-of-life-handling, making producers responsible for the end-of-life fate of products.[273] Prices of goods must reflect all these costs, based on their full environmental impact.

The application of environmental law to ensure ecological efficiency of economic activities is inevitable for the survival of mankind on "spaceship Earth". Moreover, environmental stewardship contributes to the company's image and could form a unique selling proposition making the product stand out of the crowd and additionally enabling the skimming of the market, if a consumer surplus exists. The continuously growing market for organically grown food, cleaner cars, products with the certificates of the Marine and Forrest Stewardship Council

[270] [UN Global Compact 01], Principle 8
[271] [UN Global Compact 01], Principle 8
[272] [UN Global Compact 01], Principle 7
[273] [EA UK]

(guaranteeing sustainable business practices), etc. are evidence for the rising consumers' demand of products avoiding negative external effects on the environment. Despite the recent developments on the financial markets the author has found an increasing interest (and therefore supply) of investors in clean tech industries and sustainability funds. The Dow Jones Sustainability Index components e.g. are selected by a systematic corporate sustainability assessment and include only the leading companies committing to sustainability, giving incentives to firms to increase long-term shareholder value by integrating economic, environmental and social factors in their business strategies.[274]

[274] [Sustainability Indexes]

C A S E S T U D Y:

THE AGRICULTURAL USE OF STREPTOMYCIN AGAINST FIRE BLIGHT IN AUSTRIA

(INCLUDING A COST-BENEFIT ANALYSIS)

C1. Introduction

Fire blight (FB) is an highly infectious[275], serious[276], plant disease affecting several pome fruit and ornamental plants[277]. Susceptible to FB are fruit trees of high commercial interest such as apple, pear and quince; hence the occurrence of FB in orchards can cause "severe economic losses"[278]. Since there are no curative FB remedies, it is found hard to control[279] and has spread all over the continents of the world from America, first being discovered in Austria in 1993. Effective, environmentally compatible prevention methods are needed. In Austria (and other countries), however, it is still fallen back on the agricultural use of streptomycin as a chemical plant protection agent, forbidden on EU-level since 2004, but enabled by a derogation-clause. Due to possible human health hazards caused by the antibiotic and the possibility of contamination of fruit and honey, controversies[280] have arisen.

As the theoretical part of this thesis has covered the possible interactions between governments and economic power regarding the implementation and enforcement of environmental law, this case study shall evaluate the pros and cons with a cost benefit analysis to measure the economic reasonableness of this procedure.

The calculation will encompass different scenarios comparing the use of streptomycin to another (biological) plant protection agent called "Blossom Protect" (produced by bio-ferm GesmbH), which IMHO seems (amongst others) to be a viable competitor at hand in Austria.

C2. Main Issues on Fire Blight

The (unique[281]) causative agent of the plant-pathogen FB is a bacteria species called Erwinia amylovora (E.a.)[282] causing

- Blossom blight (wilting of blossoms)

[275] [AGES 01], p. 3; [LKÖ 03], p. 45

[276] [Vanneste 2000]: "most devastating bacterial desease of apples and pears"; [Moosbeckhofer et al 2007]; [Cabrefiga 2004], p. 75; [AGES 01], p. 2; [LKÖ 03], p. 45

[277] EC 2000/29, p. 51: "Subject of contamination: Plants of Amelanchier Med., Chaenomeles Lindl., Cotoneaster Ehrh., Crataegus L., Cydonia Mill., Eriobotrya Lindl., Malus Mill., Mespilus L., Photinia davidiana (Dcne.) Cardot, Pyracantha Roem., Pyrus L. and Sorbus L."

[278] [AGES 10], p. 5 and [BMLFUW 01], (translated by the author)

[279] [AGES 01], p. 3 et seqq.; [AGES 01], p. 7: "a pear tree can die off within two or three weeks, with apple trees the desease is slower and less severe.

[280] On parliamentary level see e.g. [XXIII.GP 448-AB]; [Pirklhuber 03_2008]

[281] [Vanneste 2000], p. 5

[282] Named after the scientist Erwin F. Smith; see [USDA ARS 02]

- Twig blight (withering of leaves)
- Shoot blight (drying out of young shoots)
- Canker blight (infections can over-winter in cankers, and can cause wilting of stems near the canker)
- Rootstock blight
- Trauma blight ("sudden, widespread occurrence of fire blight on many tissues following hail, severe wind or late frost damage when the populations of the bacteria on the foliage are high"[283].

Symptoms observed with FB are the change of young shoots and leaves to brown or black colour, sometimes bending in[284]. This discolouration appears like the tree is burnt, the name deriving thereof. Dead leaves and dried-out fruit remain on the branches. Further E.a. causes a red-brownish discolouration of tissue underneath the bark and can cause (particularly in spring) yellowish bacterial ooze dropping down from infected tissues.[285]

Figure 3: Fire blight infected apple tree; Source: [bio-ferm 01]

The life cycle of the bacteria causing FB is pointed out to be special, as it can survive in inconspicuous cankers and uses symptomless carriers, which may be according to [Vanneste 2000], p.3 one of the reasons of the sudden outbreaks of FB.

Climatic conditions in favour of bacterial multiplication on the stigmas are temperatures above 18°C[286] and humidity above 70%[287] (the bacteria needs the water to migrate and enter the tissues[288]). E.a. can enter the tree through natural openings (stigmas), e.g. damages caused by hail, with blossoms to be seen the

[283] [Longstroth 2007]
[284] Because of this, it is referred to a "shepherds crook", when describing the symptoms.
[285] See [Wilcox]; [Steiner et al 1998]; [Longstroth 2007]; [AGES 01]
[286] [AGES 01], p. 7
[287] [AGES 01], p. 7
[288] [Vanneste 1996], p. 67N

"main port of entry"[289]: "Before entering the tissues, E. a. colonises the stigmatic surfaces of the flowers."[290]

The maximum time of risk for the spread of this bacterium is late spring to early summer. Infected plants can die off within a short time[291], not only destroying the crop but the whole tree.

The bacteria is suspected to be disseminated over long distances via contaminated (plant) material[292] and (migrating) birds and locally through wind (which causes tiny cracks), rain (splashing) and watering, insects[293], but also via infected gardening tools and tires of vehicles, etc.[294] E.a. is being found to have many ways to spread[295], further contributing to the difficulties to control this plant disease.

At the moment there is no (real) cure (In the sense of really healing the plant disease) available against FB, furthermore we still have no information as tot the pathogenic character of the bacteria (it is not identified yet, what makes E.a. to be the FB tree-killer[296]).

Therefore only preventative measures can be taken. If a tree has already been attacked by FB the only possibility remaining is to cut infected branches or clearing the whole tree.

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[289] [Vanneste 1996], p. 67N

[290] [Vanneste 1996], p. 67N

[291] [Vanneste 2000], p. 2: "[…] the disease can migrate from on infected flower, down to the rootstock, killing the tree in one season"; [BMLFUW 01]: "within 2-3- weeks a young pear tree can be dead" (translated by the author)

[292] For further information e.g. see [Taylor et al 2003] "Survival of the fire blight pathogen, Erwinia amylovora, in calyxesof apple fruit discarded in an orchard"

[293] But according to [Vanneste 2000], p. 10: "the most probable orgin of inoculum to start the spring cycle of fire blight is the spread of bacteria from overwintering cankers to open flowers." Other sources (like e.g. beehives) have not been proven to be an orgin of new inoculum for new infections.

[294] [AGES RT10], p. 40

[295] But it does not spread via apples as research work suggests. See [Taylor et al 2002]; and [Roberts et al 2008]: "An updated pest risk assessment for spread of Erwinia amylovora and fire blight via commercial apple fruit".

[296] [Vanneste 2000], p. 5

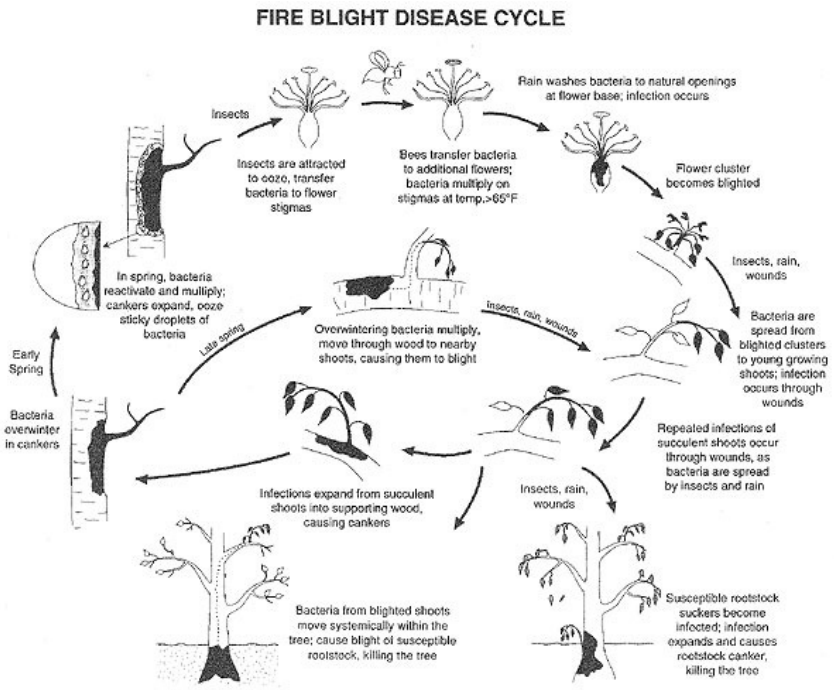

Figure 4: "Disease cycle of Erwinia amylovora"; Source: [Wilcox]: E. Gotham, Cornell University.

Nowadays FB is dispersed in many countries[297] all over the world.

The symptoms of FB have been reported already 1780 in U.S., from there the pathogen made its way around the world reaching the UK in 1957, moving westwards on the European mainland arriving in Germany in 1971 and in France in 1972, reaching Austria by 1993 in the province of Vorarlberg.

C2.1. The Costs of Fire Blight

The damage caused by FB can be substantial for a full-time-fruit-grower. It can cause severe losses in one harvest-period. The cost of destruction of orchards is to be seen as the sum of:

- Clearance costs
- Harvest loss in the clearing period and the following years
- Planting costs of new trees.

On the other hand there are costs being saved such as harvest and pruning costs.

[297] [AGES 01], p. 3: EUROPE: Albania, Belgium , Bosnia-Herzegowina, Bulgaria, Denmark, Germany, France, Greece, Ireland, Italy, Croatia, Slowenia, Liechtenstein, Luxemburg, Macedonia, Moldawia, Netherlands, Norway, Austria, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Serbia, Czech Republic, United Kingdom, Hungary, Cypress; AFRIKA: Egypt; Asia: Armenia, Iran, Israel, Jordania, Libanon, Turkey; AMERICA: Bermudas, Guatemala, Canada, Mexico, USA; OCEANIA: New Zealand.

[Steinbauer 2008] has served as basis for the calculation.[298] Costs per unit of machines used (depreciation for wear and tear) and costs for work force are subject to change and are to be adapted yearly. These values are calculated via the "ÖKL"-standard rate for machines and equipment net cost and the "Maschinenring" (MR)-standard rate for working costs. The Maschinenring pays out the ÖKL target rates (these are calculated by the Austrian Board of Trustees for Land technology and development (ÖKL, Österreichisches Kuratorium für Landtechnik und Landentwicklung) and are bindingly acknowledged. Because the documents containing these standard rates are subject to payment, they are adopted unrevised by the author. Further the units needed per hectare are average values of clearances in Styria, which cannot be recalculated by the author because of missing raw data[299] and are also adopted as per the existing calculation [Steinbauer 2008]. The stated sources of this calculation are put in parenthesis at the right hand side of the values in the following tables 1-4 and are stated at the bottom in table 5.

*Table 1: Basic assumption on Annual gross profit/ha of an **Apple** Orchard; Source: [Steinbauer 2008]:*

	Average Yield/ha Winter-Apples		Average Price/kg Apples	
2005	39,00	(1)	€ 0,26	(2)
2006	32,50	(1)	€ 0,35	(2)
2007	39,00	(1)	€ 0,45	(2)
Average:	36,83		€ 0,35	
Average gross profit/ha	**€ 13.014,44 (a)**			

(*) Diverging from the value in [Steinbauer 2008]: €12890,50

*Table 2: Loss caused by Fire Blight in Intensive **Apple** Orchards in Austria; Source: based on [Steinbauer 2008], adapted by the author:*

First year (year of clearing)

Clearing costs/ha	Units/ha		Costs/unit		Total/ha
Standard working hours (MR / small tool):	125	(3*)	€ 18,00	(4)	€ 2.250,00
Orchard-Tractor (68PS, 4WD)	35	(3)	€ 40,12	(5)	€ 1.404,20
Forestry tumbril with crane (6t)	17,5	(3)	€ 13,31	(5)	€ 232,93
Tipping trough, hydraulic (width: 1,6m)	17,5	(3)	€ 1,35	(5)	€ 23,63
					€ 3.910,75

[298] The calculation requires expert knowledge. Only limitied possibilities were found by the author to create a calculation scheme from online available resources ([Handler et al 2006] and [Mouron 1999] have been found, but have only delivered fragmented information). The AGES has only provided 2 pages ([AGES15] and [AGES 17]) of information, being too unspecific, accumulated and out of date for incorporation.

[299] The only comparison data received from AGES is a one-page document ([AGES 17]), stating the (estimated?) sum of FB damages in 2003.

0% Harvest					
Average gross profit/ha: 100% lost					€ 13.014,44
Reduced harvesting costs/ha: 100%					-€ 832,80
	Hours/ha		Costs/hour		Total/ha
Family worker	113	(6)	€ 0,00	(10)	€ 0,00
Contract manufacturing worker	120	(6)	€ 6,94	(7)	€ 832,80
				Total	€ 832,80
					€ 12.181,64
			Total Costs Year 1		€ 16.092,39
Second year (year of new planting)					
Costs of reinvestment (replanting)	Units/ha		Costs/unit		Total/ha
Planting material (2y-tree with 1y-crown)	3230	(8)	€ 4,10	(9)	€ 13.243,00
Contract manufacturing worker	80	(6)	€ 6,94	(7)	€ 555,20
Family worker	25	(6)	€ 10,00	(10)	€ 250,00
Orchard-Tractor (68PS, 4WD)	25	(3)	€ 40,12	(5)	€ 1.003,00
Tipping trough, hydraulic (width: 1,6m)	25	(3)	€ 1,35	(5)	€ 33,75
					€ 15.084,95
0% Harvest					
Average gross profit/ha: 100% lost					€ 13.014,44
Reduced harvesting costs/ha: 100%					-€ 832,80
Reduced pruning costs/ha: 50%					-€ 585,00
	Hours/ha		Costs/hour		Total/ha
Working costs (11)	90	(6)	€ 13,00	(4)	€ 1.170,00
					€ 11.596,64
			Total Costs Year 2		€ 26.681,59
Third year					
Only 33% Harvest					
Average gross profit/ha: 67% lost					€ 13.014,44
Reduced harvesting costs/ha: 67%					-€ 557,98
Reduced pruning costs/ha: 33%					-€ 193,05
			Total Costs Year 3		€ 11.871,47
Fourth year					
Only 67% Harvest					
Average gross profit/ha: 33% lost					€ 13.014,44
Reduced harvesting costs/ha: 33%					-€ 274,82
Reduced pruning costs/ha: 16,67%					-€ 97,52
			Total Costs Year 4		€ 12.642,10
			Possible Total Economic Loss/ha		€ 67.287,56

*Table 3: Basic assumption on Annual gross profit/ha of a **Pear** Orchard; Source: [Steinbauer 2008]:*

	Average Yield/ha Winter-Pears		Average price/kg Pears	
2003	35,00	(1)	€ 0,44	(2)
2004	35,00	(1)	€ 0,36	(2)
2005	35,00	(1)	€ 0,30	(2)
2006	26,00	(1)	€ 0,37	(2)
2007	35,00	(1)	€ 0,37	(2)
Average:	33,20		€ 0,37	
Average gross profit/ha	**€ 12.217,60 (b)**			

*Table 4: Loss caused by Fire Blight in Intensive **Pear** Orchards in Austria; Source: based on [Steinbauer 2008], adapted by the author:*

First year (year of clearing)					
Clearing costs/ha	Units/ha		Costs/unit		Total/ha
Standard working hours (MR / small tool):	100	(3*)	€ 18,00	(4)	€ 1.800,00
Orchard-Tractor (68PS, 4WD)	30	(3)	€ 40,12	(5)	€1.203,60
Forestry tumbril with crane (6t)	15	(3)	€ 13,31	(5)	€ 199,65
Tipping trough, hydraulic (width: 1,6m)	15	(3)	€ 1,35	(5)	€ 20,25
				Subtotal	€ 3.223,50
0% Harvest					
Average gross profit/ha: 100% lost					€ 12.217,60
Reduced harvesting costs/ha: 100%					
	Hours/ha		Costs/hour		Total/ha
Family worker	70	(6)	€ 0,00	(10)	€ 0,00
Contract manufacturing worker	74	(6)	€ 6,94	(7)	€ 513,56
					€ -513,56
				Subtotal	€ 11.704,04
				Total Costs Year 1	**€ 14.927,54**
Second year (year of new planting)					
Costs of reinvestment (replanting)	Units/ha		Costs/unit		Total/ha
Planting material (2y-old tree, grafted)	1540	(8)	€ 5,50	(9)	€ 8.470,00
Contract manufacturing worker	45	(6)	€ 6,94	(7)	€ 312,30
Family worker	15	(6)	€ 10,00	(10)	€ 150,00
Orchard-Tractor (68PS, 4WD)	15	(3)	€ 40,12	(5)	€ 601,80
Tipping trough, hydraulic (width: 1,6m)	15	(3)	€ 1,35	(5)	€ 20,25
				Subtotal	**€ 9.554,35**
0% Harvest					
Average gross profit/ha: 100% lost					€ 12.217,60
Reduced harvesting costs/ha: 100%					-€ 513,56
Reduced pruning costs/ha: 100%					
	Hours/ha		Costs/hour		Total/ha
Working costs (11)	90	(6)	€ 13,00	(4)	€-1.170,00
				Subtotal	**€ 10.534,04**
				Total Costs Year 2	**€ 20.088,39**
Third year					
0% Harvest					
Average gross profit/ha: 100% lost					€ 12.217,60
Reduced harvesting costs/ha: 100%					-€ 513,56
Reduced pruning costs/ha: 75%					-€ 877,50
				Total Costs Year 3	**€ 10.826,54**
Fourth year					
0% Harvest					
Average gross profit/ha: 100% lost					€ 12.217,60
Reduced harvesting costs/ha: 100%					-€ 513,56
Reduced pruning costs/ha: 50%					-€ 585,00
				Total Costs Year 4	**€ 11.119,04**
Fifth year					

33% Harvest		
Average gross profit/ha: 67% lost		€ 8.8185,79
Reduced harvesting costs/ha: 67%		-€ 344,09
Reduced pruning costs/ha: 33%		-€ 386.10
	Total Costs Year 5	**€ 6.671,71**
Sixth year		
67% Harvest		
Average gross profit/ha: 33% lost		€ 4.031,81
Reduced harvesting costs/ha: 33%		-€ 169,47
Reduced pruning costs/ha: 16,67%		-€ 195,04
	Total Costs Year 6	**€ 3.667,29**
Possible Total Economic Loss/ha with 100% FB loss:		**€ 67.008,01**

Table 5: Footnotes to Table 1-4; based on [Steinbauer 2008]

(1) The stated source is the Austrian Statistics Office (values are adapted annually)
(2) The stated source is the Obsterzeugerorganisation Steiermark GesmbH. The organisation markets 80% of the Styrian pome fruit production (values are adapted annually)
(3) Average units needed at clearings in Styria [Steinbauer 2008]
(4) MR (Maschinenring) -standard rates for labour costs (values are adapted annually)
(5) ÖKL-standard rate for machine and tool net costs (annually adjusted)
(6) Economic analysis of the consultancy group "Kernteam"-LK Styria (50 farms, 1999-2001)
(7) Peasant-collective contract (annually adjusted)
(8) Average planting density in apple orchards in Styria, (Austrian Statistics Office, adjusted every five years); [Steinbauer 2008]
(9) Average price in Styria (annually adjusted) [Steinbauer 2008]
(10) Variations of costs in the calculation sometimes using "0.00/h", then again "10.00/h" are not clear to the author, but have been taken over without verification (out of the scope of the paper).
(*) Seeming appropriate in comparison to Swiss calculation found [Mouron 1999]
(a) Diverging from the value in [Steinbauer 2008]: €12890,50
(b) Diverging from the value in [Steinbauer 2008]: €12.284,00

As shown below (in the tables 6 and 7) further the economic loss of caused by FB in intensive apple orchards in Austria must be corrected by weighing factors depending on the

- Cultivars (55% of Styrian apple-acreage and 30% of all Styrian pears belong to the group 2 with 0% surcharge).
- Division of (cleared) orchards into three groups according to the orchard age.

Table 6: Values dependant on (cleared) orchard cultivars; Source: [Steinbauer 2008]

Group	Apple Cultivars	Pear Cultivars	Weighing Factor
1	Arlet; Braeburn; Elstar; Fuji; Gala; Kronprinz R.; Pinova; Roter Boskoop; Rubinette; Summerred; Topaz	Abbe Fetel; Bosc's F.; Concorde; Uta; William's Ch.	+33%
2	Golden Delicious; Idared; Jonagold	Alexander L.; Packham's Tr.; Conference	0%
3	Akane; Alkmene; Boskoop; Burgundy; Cox Orange; Delbard Estivale; Empire; Fiesta; Gloster; Granny Smith; Jonadel; Jonathan; Lobo; Mc Intosh; Mutsu; Red Delicious; Red Winter	Guyot; Clapp's L.; Gute Luise; Pastorenbirne; Pr. Drouard	-33%

Table 7: Decreased value dependant on (cleared) orchard age; Source: [Steinbauer 2008]

	Age Apple Orchard	**Age Pear Orchard**	**Deduction**
Group 1	1-10 years	1-18 years	0%
Group 2	11-14 years	19-24 years	-33%
Group 3	15-18 years	25-30 years	-67%

The Net Present Value (NPV) will be needed later on in the Cost Benefit Analysis and will therefore be provided at this point. The NPV is calculated by the discounted values according to how far ahead in time the benefits or costs will be striking. Considering an interest rate of 5% p.a. the author has calculated the NPV of the possible 100% loss of one hectare of an apple orchard to be (NPV^{Apple}):

$16092.32 + 26681.59/1.05 + 11871.47/(1,05)^2 + 12642.10/(1,05)^3 = 63190.92€$

Likewise the NPV^{Pear} is:

$14927.54 + 20088.39/1.05 + 10826.54/(1,05)^2 + 11119.04/(1,05)^3 + 6671.71/(1,05)^4 + 3667.29/(1,05)^5 = 46919.09€$

C2.2. Measures Available Against Fire Blight

In light of the damage FB can cause, measures to minimize the losses have to be taken. The following list names the main strategic actions (control methods) available to control FB (not making the claim to be complete):

Overhead Control: installation of risk assessment systems and central management of actions taken is important.[300] Austria's respective body is the AGES, being responsible for the coordination of all measures against FB (details further down).

Reduction of further spreading: regulation has to inhibit the transfer of infected host plants (from infected regions) to regions still considered to be free of E.a. (quarantine rules), also by control and management of (tree) nurseries and plant trading (import control).[301] In Austria this is realized by the Plant Protection Law 1995 and the Plant Protection Regulation 1996.[302]

Reduction of planting host plants: the decimation of host plants used for decoration including the ban of susceptible plants and symptomless carriers (e.g. cotoneaster) from public places such as parks, medial strip of highways or similar. This measure also includes informing the general public on the threats of FB on plants species found in private gardens. In South Tyrol (Italy) being "the" fruit growing country (not falling back on the usage of antibiotics), there have been rigorous clearances of shrubs being host plants to FB (also in private gardens), to limit the infection pressure. In Austria this strategy was not politically feasible, because private garden owners were not cooperative, but it is stated that (some) host plants as (e.g. cotoneaster) are now forbidden to be sold by tree nurseries in Austria.[303]

Selection of less-susceptible plants: pushing selection and engineering of plants with Systemic Acquired Resistance (SAR) to the pathogen and tactical planting of varieties with a good ratio of low susceptibility to FB and market value.[304]

Research conclusions: a "thorough understanding of the epidemiology of E.a. is critical in controlling this devastating disease. It is possible to utilize epidemiological knowledge of the pathogen to find weak spots or areas where the pathogen can be eliminated or reduced."[305] For example findings like [Gunen et al 2005], who have researched on the phenolic content in the leaves of pear cultivars combined with the rating of the cultivars' susceptability grade to fire

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[300] [Vanneste 2000], p. 5
[301] [Donat et al 2007]
[302] [BMLFUW 01], see BGBl. Nr. 253/1996
[303] Stated in [Interview ÖIB] by Mr. Ulz
[304] For a list see [LKÖ 02]; [OÖLR 02]; [AGES 12] and [AGES 13]; for further studies [Schlangen 2007]
[305] [Vanneste 2000], p. 30

blight, are neeed for forthcomings in breeding resistant plants. Further research work has to provide practical action recommendations. Regarding the investigation on new plant protection agents, refinement of found agents and the possibilities of combination of these trials in laboratories, glass houses or in open land are a very important learning source.

Monitoring: accurate monitoring of particularly orchard trees, but also all other host plants is necessary to identify symptoms early. Aware of the fact that E.a. multiplies preferentially on the stigmatic surfaces, this calls for regular monitoring in endangered areas for the presence of E.a. to anticipate control requirements and FB outbreaks.[306] The quick clearance lowers the infection pressure by eliminating sources of infection is dependent on rigorous monitoring[307], but the "scouting for the disease is expensive and time-consuming"[308].

Computer-based Forecasting: ensuring control over a wide range of climatic conditions information technology helps to develop computerized predictive models for infection[309]. Knowledge about the ecology of E.a. on stigmas (favourable environmental and plant conditions of the pathogen) combined with actual and forecasted weather condition (monitoring of the many conditions influencing the spreading of E.a.) are the input for calculating the infection probability and subsequent warnings.

The installation of computer forecasting systems enables better timing of monitoring and spraying strategies.

The most widely used and best validated systems stated in the "three-country" reports (Germany, Switzerland, Austria) on FB are:

- "Billing's Integrated System 95 after Billing (1995)"
- "Maryblyt™ Version 4.3. after Steiner (1996)"
- "Cougarblight after Smith (1998)"

Permanent enhancement[310] of these systems should be pursued to ensure utmost congruency of forecasted and actual conditions. Nevertheless these systems are found to be stated using the exact wording, showing that the text has been copy-

[306] [Vanneste 2000], p. 30; [BMLFUW 01]
[307] [DBMELV 2004], p. 29
[308] [Kuflik et al 2008], p. 118
[309] [Johnson et al 1998]; [Kuflik et al 2008], p. 118
[310] See also [Kuflik et al 2008]: "Optimization of Fire blight scouting with a decision support system based on infection risk"

pasted from year to year, in the years 2005-2007[311], with not even the version of the forecasting systems changing. Additionally with the years in the brackets, being assumed to describe the systems' establishing year is IMHO rather strange compared to the ongoing developments perceived in the concerned disciplines of IT such as Fuzzy Logic, Artificial Intelligence, etc. and it can only be hoped, that these systems are calibrated appropriately.

Sanitary measures (organic control): once a tree shows infections the only measure available is to eliminate the pathogen parts: branches must be pruned back (cut back) well into sane wood, trees with diseased stems or roots must be cleared completely. Infected plant material shall not be transported openly in the orchard, because the bacteria can survive also on cleared wood for quite a long time[312]. The infested wood must therefore be burnt and tools used disinfected in situ[313] to prevent the spreading of the pathogen.

Well-balanced manuring: heavy nitrogen fertilization should be avoided as it causes strong succulent growth, which is most susceptible to FB.[314]

Plant Protection Agents: the spraying of plant protection agents shall either help killing the E.a.-bacterium (by Antibiotics) or withdraw the means of existence (by Antagonists) or enhance the plant resistance (plant resistance improvers).[315]

Honey-bees as vectors: since "the interaction between the pathogen and biological control agents has to occur on the stigmas"[316] and pollination in orchards is usually reinforced by honey bees contacting the blossoms, using bees as vectors to disperse biological control agents to the flowers has been subject to scientific research. [317] The antagonist Blossom Protect (hereafter: BP) (which is considered more detailed later on in this paper), for example, can be dispersed by honey bees, because it has been shown that it is not harmful to the bees, and also no residues can be found in honey. But the application of BP via dispenser is not always advantageous (secure) since the bees will always take their way to the

[311] [DBMELV 2005], p. 17; [DBMELV 2006], p. 20; [DBMELV 2007], p. 24
[312] Studies reach from a couple of month to years.
[313] [Vanneste 2000], p. 5
[314] [Steiner et al 1998]; [BMLFUW 01];
[315] See e.g. [Brisset 2007]
[316] [Vanneste 1996], p. 67N
[317] For further studies see [AGES 10] and [Moosbeckhofer et al 2007]

most attractive food source: as bees favour e.g. rape above apple blossoms, the bees will fly to the rape if available and not in the orchard.[318]

Information management: it is also important to inform not only fruit growers but also the general public about if informed about the symptoms and the possible host plants of the disease, the notification requirement and the actions to be taken in case of suspicion are to be used as additional monitoring sources.[319] Further distribution of information encompasses basic information on the epidemiology of FB, reports on FB occurrence, possible measures to be taken and information regarding scientific forthcomings in all these areas. This can be achieved by a multi-media strategy placing articles in newspapers and journals, making information available via Internet, distributing flyers and organising information-events.[320]

The author states explicitly that mentioned actions are only a list of all found possibilities without ranking or recommending these. However, to control the dissemination of FB a conglomerate of some of these measures mentioned will be necessary. [Vanneste 2000] e.g. states that the "control of FB cannot be obtained with a single 'silver bullet' strategy but requires the utilization of all available knowledge about the epidemiology of the pathogen"[321]. Furthermore it is necessary to bear in mind, that some of these measures are obligatory.[322] In the EU FB is a quarantine pest and is has to be registered. If a FB infection is suspected the FB representative of the municipality, the FB expert of the district or the Official Austrian Plant Protection Service (APSD) are to be informed and samples should be sent to the Austrian Agency for Health and Food Safety (AGES) for diagnosis. Also there are obligations regarding clearance and pruning rules of infected trees (or their parts) in Austria. In Switzerland, however, the clearance obligation was recently defeated by an appeal to the court of justice worsening the infection pressure situation. There seems to be a clear coherence between this year's authorization of streptomycin even in Switzerland and this worsened situation for the orchardists' infection pressure. Likewise in South Tyrol (were antibiotics are strictly not used) holding the pressure from host-plants down can be seen as a pivotal factor to success without antibiotics. These measures are therefore not to be underestimated. Of course setting standards on

[318] [Interview ÖIVB]
[319] [DBMLEV 2004], p. 29
[320] As for example suggested in [AGES 11], p. 16
[321] [Vanneste 2000], p. 30
[322] Also for private landowners, see e.g. [LKÖ 01]

what a private garden is allowed to have planted is political hara-kiri (the full social benefits being underestimated, and individuals reacting in regard to personal utility maximization, hence individualism) and was perhaps only feasible in South Tyrol, where fruit growing is important to such a high degree that public could be convinced of the necessity of this measure.

However, controlling the spreading of FB also includes the spraying of plant protection agents and in this paper the author will explore two different possibilities of sprayings against FB: the antibiotic streptomycin and the bacterial antagonist Blossom Protect.

C2.2.1. The Antibiotic "Streptomycin"

Amongst the measures available for the control of FB the spraying of bactericides is a possibility, which is about applying products containing streptomycin (also called "streptomycine"). The antibiotic is marketed as the sulphate salt of streptomycin ("streptomycin sulphate") and will be simply referred to as "streptomycin" in the following. It is available as a powder, pellets or emulsifiable concentrate[323], belongs to a class of drugs called aminoglycosides[324] and is water-soluble.[325]

Streptomycin has the molecular formula: $C_{21}H_{39}N_7O_{12}$[326] and is a bactericidal antibiotic, inhibiting protein synthesis by damaging cell membranes of sensitive microbial cells, binding to the 16S rRNA of the bacterial[327] ribosome, stopping the production of essential proteins needed by the bacteria to survive.[328] Streptomycin is a broad spectrum antibiotic as it inhibits both gram positive and gram negative bacteria.[329]

As stated above there is no remedy for FB once a tree is infected with E.a. Therefore antibiotics (as every other plant protection agent) can only be applied as a preventative measure before the outbreak of FB. It is important to note that also the spraying of antibiotics can not cure trees suffering from an infection.

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[323] [Drugs Pro]; [EXTOXNET]
[324] [Primaryinfo]
[325] [EXTOXNET]: "Solubility in water is greater than 20 mg/ml".
[326] [ENIUS]
[327] Human ribosomes are structured differently from bacteria.
[328] [Wikipedia 02]; [Primaryinfo], see further: [Gideononline]; [Drugs Pro]; [MP Biomedicals]
[329] [Gideononline]; [Primaryinfo]

Even in an article in the "Austrian Medicine Magazine"[330], available via the AGES homepage, it is wrongly (!) postulated that streptomycin is the only "effective measure against fire blight, next to clearing"[331] under the header "alternative to clearing".

First isolated in 1943 it was found to help curing tuberculosis[332] and other infectious diseases, e.g. Pasteurella pestis (plague), also being used in veterinary medicine (horse/cattle/sheep)[333], and to control bacteria in crops (including E.a.).

Early production of the drug was dominated by Merck & Co.[334]; further manufacturers of streptomycin are GlaxoSmithKline plc.[335], Pfizer Inc.[336]. See [NOAA] for a more extensive list for alternate names for the chemical, including trade names, synonyms, and foreign names.

C2.2.2. An Antagonistic Product: Blossom Protect

A solution which has been shown to play a role in reducing incidence of FB apart from the deployment of antibiotics are other bacterial epiphytes, which also colonize stigmas, counter-attacking the bacteria E.a., by filling the ecological niche provided by the stigma with a non-pathogenic, competing microorganism, taking away or minimizing it's life conditions and suppressing reproduction and hence spreading of the pathogen.[337]

Underpinning arguments for the working mechanism of antagonists are for example:

"Preemptive exclusion of the pathogen E. amylovora by surface colonization and nutrients depletion, and cell-to-cell interaction appear to be the main mechanisms of biocontrol."[338]

"Pre-emptive colonisation by beneficial bacteria of the stigmas, where E. amylovora usually multiplies, can be enough to prevent the pathogen from multiplying and infecting the plant."[339]

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[330] "Österreichische Ärztezeitung": [Pesata 2008], .p50
[331] [Pesata 2008], .p50 (translated by the author)
[332] "in combination with other drugs" - [WHO 02]
[333] [VN], [Wikipedia 02], [ENIUS],
[334] [Wikipedia 02]
[335] according to [Primaryinfo]
[336] according to [Primaryinfo]
[337] See [Johnson et al 1998]
[338] [Cabrefiga 2004]. p. 75

As an example of an antagonistic product the biological plant protection product "Blossom Protect" (BP) is reviewed in comparison to the use of antibiotics: BP is based on two active ingredients (isolates of Aureobasidium pullulans (Ap.)) which are "dematiaceous[340] fungi"[341] populating the receptacle of the cultivated (treated) plant and so inhibiting the intrusion of the FB bacteria: "for blossom infection to occur, the causal bacterium, *Erwinia amylovora*, needs to increase its population size through an epiphytic phase that occurs on stigmatic surfaces"[342] but the antagonistic microorganisms contained in BP already grows in the sprayed blossoms. Moreover BP produces compounds inhibitory to E.a. due to establishing a very low pH-value showing antagonistic potential against E.a.[343] Ap. is found to be "distributed widely throughout the environment, populating apple trees naturally" and "is not genetically modified". It has been developed and is produced by the company bio-ferm GesmbH in Tulln, Austria, being founded by scientists of the University of Natural Resources and Applied Life Sciences, Vienna. BP has been introduced as an alternative to antibiotic treatment e.g. by experts such as [Blum et al 2007] and is strongly recommended by organisations directed towards environmental protection (e.g. [Gubler-Merz]; [AG FB 2008]).

Because this plant protection agent (and other agents working in comparable ways) is not killing, but "only" opposing the bacteria, it might have been underestimated and shrugged off too quickly in the past. It should be allowed for the other side of the medal, that this fact logically excludes concerns regarding the threats of resistances (and the correlating problems), for "to oppose the acids produced by BP E.a. would have to change their complete genome".

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[339] [Vanneste 1996], p. 67N

[340] So-called "black yeasts", being pigmented yeasts (dematiaceous = "having a dark colour").

[341] "A.pullulans is a yeast like fungi belonging to the group of dothideales, some strains of A. pullulans are used in food technology for the production of 'pullulan' (capsules of medicaments, 'eatable paper')." According to [Interview bio-ferm]

[342] [Johnson et al 1998]

[343] [Loncaric et al 2007]; [Purkarthofer 2008]; [Interview bio-ferm]: "[A] low pH is known to be unfeasible for propagation of Erwinia [amylovora]"

C2.2.3. Excursus: Further Plant Protection Products

There are also further products available for plant protection against FB. Below a short overview (the list not being exhaustive):

Table 8: Further plant protection products; Source: [lawa 2008]

Trade name	Company	Agent; Description	Concentration	Outlay[344]	Water	Effects
Mycosin [345]	AgraQuest, Inc. USA,	Clay, Equisetum; "Biological bactericide/fungicide with a part effectiveness against FB blossom infections on pome fruit"[346]	0,5%	8kg/ha	400-500 l/ha	[Kunz et al 2000] states that Mycosin effects up to 85%. "With Myco-Sin a considerable effect was also achieved with fire blight in pome fruit."[347]
Serenade WPO[348]	Stähler Suisse SA in CH	"Bacillis Subtilis"; Valid for organic agriculture. Positive environmental behaviour not harmful to rainworms, bees, etc.	0,625% (625g/l of water)	10kg/ha		Only partial effectiveness: 50%-60%
Regalis	Stähler Suisse SA in CH	Prohexadione-Calcium; Bioregulator against FB-secondary infections on pome fruit.	0,16%* + 1600l water	2,5 kg/ha		

* with a tree volume of 10000m^3/ha

[344] at a tree volume of 10.000m3/ha
[345] see [lawa 2008], p. 6
[346] [lawa 2008], p. 6 (translated by the author)
[347] [Heitefuss et al]; see also [Agroscope]
[348] [lawa 2008], p. 10-11

Further alternatives found by the author are:

Pseudomonas fluorescens "A biological control agent, *Pseudomonas fluorescens* EPS62e, was isolated from the surface of a pear fruit […] and […] was evaluated for suppression of immature fruit, blossom and shoot infections, under controlled environment conditions, providing control levels similar to chemical control with copper or antibiotic compounds. The strain colonize and survive well in wounds on immature fruits, young leaves and flowers, and reduce significantly fire blight infections in these plant organs when applied in preventive treatments."[349] And [Pujol et al 2005] has published an article "Development of a strain-specific quantitative method for monitoring Pseudomonas fluorescens EPS62e, a novel biocontrol agent of fire blight" stating that "Pseudomonas fluorescens EPS62e has been selected in a screening procedure for its high efficacy controlling Erwinia amylovora infections in flowers, immature fruits and young pear plants." Already [Johnson 1998] writes about the "bacterial antagonist of *E. amylovora* (BlightBan, *Pseudomonas fluorescens* A506)".

And even earlier in [FAO 1993] it is stated that "In field trials conducted in 1991 and 1992 […] Pseudomonas fluorescens strain A506 and Erwinia herbicola strain C9-1 established epiphytic populations on pear blossoms and were effective antagonists for the biological control of fire blight."

In [Cabrefiga et al 2004] the results of three tested bioagents (**BION®**, etheric oil from **Thymbra spicata** and the antagonistic bacterium **Rahnella aquatilis Ra39**) showed that they could reduce the "disease index of up to 63.7, 30.8 and 58.6% respectively" and decrease the "growth of bacteria up to 64.2, 49.5 % and 63.8% respectively"[350]. The promising plant protection agent **BPMC 2023** mentioned in [DBMELV 2003] is a precursor of Blossom Protect (explained in detail in this study). Furthermore one also needs to mention **"Bloomtime"** of Bioscience.

Eduard Holliger (from the Swiss research institute "Agroscope Changins-Wädenswil") also researches on hemp-brew that has been shown to be successful against FB.[351]

[349] [Cabrefiga 2004], p. 75
[350] [Cabrefiga et al 2004], p. 46
[351] [Schweizer Bauer]

Further Engelmeier's[352] study on "leave surface chemistry and sort-specific resistance", "Systemic resistance induced by benzothiadiazole in pear inoculated with the agent of fire blight (Erwinia amylovora)" by [Sparla 2004] and the finding of [Brisset 2007] that Acibenzolar-S-methyl is a chemical inducer of systemic acquired resistance in several annual plants will hopefully lead to further conclusions on the epidemiology of FB. [Baysal et al 2005] find that an Extract of Hedera helix induces resistance on apple rootstocks against FB.

As shown above there are many other possibilities yet, which are, moreover reinforced by research work such as [Mercier et al 2001]: "Field Performance of Antagonistic Bacteria Identified in a Novel Laboratory Assay for Biological Control of Fire Blight of Pear". However the products mentioned should not viewed without criticism: copper e.g. entails problems such as "copper residues in soil resulting from these fungicides impact adversely on soil biology and fertility"[353].

C3. Layers of Applicable Law

Regarding the possibilities to fight FB the different measures available were explained already. In order to use plant protection products with active agents there is a huge normative framework to be considered. For better understanding the corresponding organisations in this regulative framework are displayed in the following subchapters.

C3.1. International Level

Already law on international level regulates measures to hinder introduction and dissemination of FB (and other quarantine pests) into new territories. Relevant EU-level regulation for Plant health prescribing obligatory measures to be taken mostly does not specify exactly on these, but refer to acknowledged techniques of the EPPO or others. MS have to secure that measures implemented are adequate and effective. The guidelines of the European and Mediterranean Plant Protection Organisation (EPPO) provide fighting measures for FB (sampling, diagnosis, etc.), but also apply in the procedure of testing possible plant protection agents. Additionally EPPO also provides for an "Efficacy evaluation of plant protection products" describing "the overall process of efficacy evaluation of plant protection

[352] Stated in [Zwilling 2007]: "Mag. Dr. Doris Engelmeier Projekt "Feuerbrand 2: Feuerbrand auf Kernobst: Blattoberflächenchemie und sortenspezifische Resistenz""

[353] [Australian Gov], p. iii; the problem seems to be picked up by the EU by regulating that a maximum of 6 kg/ha/year is allowed to be used from 01.01.2006 on.

products in the registration procedure"[354]. Hence tests should be "carried out in accordance with specific EPPO Standards, where available"[355] It defines the scope of efficacy in the following way: "Efficacy can be defined by an equation in which the positive effects of the treatment in performing the desired plant protection activity (e.g. controlling the target pest or modifying crop growth) and any other useful effect, such as controlling other non-target pests, are balanced against the negative effects, such as direct damage to the crop (phytotoxicity) or effects on pollinators and natural enemies, or development of resistance. Based on EU criteria, the efficacy parameters which should be addressed for registration purposes, and which are used as the basis of this guideline, are:

- direct efficacy (effectiveness)
- resistance risk
- absence of unacceptable effects on plants or plant products (phytotoxicity; yield; quality (including transformation processes); plants or plant parts used for propagation; succeeding crops including substitute crops; adjacent crops)
- absence of unacceptable effects on production and production systems, in particular on pollinators and natural enemies."[356]

It has been tried by the author to incorporate these issues in the cost-benefit analysis established in the scope of this paper.

Further the International Plant Protection Convention (IPPC) concluded at the United Nation Food and Agriculture Organisation (FAO) is a standard setting committee. For FB the International Standards for Phytosanitary Measures (ISPMs) No. 1 "Principles of plant quarantine" and No. 11 "Pest risk analysis" apply.[357]

But also WTO Rules are applicable in the concern with FB is the "Agreement on the Application of Sanitary and Phytosanitary Measures" (SPS Agreement). According to SPS Agreement Article 2.1 "Members have the right to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are not inconsistent with the provisions of this Agreement". In general the SPS Agreement is designed to avoid disguised barriers to trade, but international standards *"are presumed to be*

[354] [EPPO 01], p. 98
[355] [EPPO 01], p. 100
[356] [EPPO 01], p. 98
[357] [FAO 2005]

consistent with the requirements".[358] These requirements are 1. non-discrimination, 2. scientific justification (being harmonized by standard-setting organisations, which in the realm of FB (plant health) is the IPPC), 3. equivalence, 4. regionalisation (specifying the pest- or disease-free areas), 5. transparency (establishing a contact point[359] responsible for the smooth running of this agreement, notification if e.g. new regulation is different than the international standard), 6. technical assistance/special treatment and control, 7. inspection and approval procedures. [Sampson 2002] states that more exacting standards (than the international) "can be applied on a provisional basis, but cannot be justified in the long term on the grounds of precaution alone", then "scientific evidence to justify the legitimacy of the restriction of imports must be provided within a reasonable period of time".

In regard to the many missing details on the knowledge of the epidemiology FB the pressure that might be imposed on risk-averse nations wanting to install high protection to their country and seek to control the pest may be restricted to do so. [Geider et al 2002] isolated more than 120 Erwinia amylovora strains to follow spread of the disease within Europe and found out that "despite barely controlled trade with fire blight host plants and associated plant products within Europe, the […] E. amylovora isolates were ordered indicating sequential spread." However, [Anderson 2000] has investigated whether the WTO's reforms on agricultural policy are consistent with domestic objectives regarding "providing adequate food security, environmental protection and viability of rural areas" (because the agricultural economic sector has a so –called "multifunctionality" task[360]) and gathers that there "is little trade-off required to meet domestic policy objectives on the one hand and agricultural protection reform objectives as embodied in WTO rules on the other".[361]

As a fact, there has been a dispute in the WTO regarding FB (U.S. vs. Japan), with the IPPC giving advice on experts in the dispute settlement.[362]

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[358] [Sampson 2002]

[359] Oddly the contact point in Austria is the Federal Ministry for Economic Affairs and Labour, see [WTO 08], p. 12

[360] [Anderson 2000]: meaning the "non-marketed externalities and public goods it produces jointly with marketable food and fibre".

[361] [Anderson 2000]

[362] [EPPO 02]

C3.2. European Community Level

The Community plant health regime was established by the Council Directive 2000/29/EC and its "general principles are based upon provisions laid down in the International Plant Protection Convention concluded at the United Nation Food and Agriculture Organisation and, in the WTO Agreement on Sanitary and Phytosanitary Measures"[363]. The European Commission[364], the Plant Health Standing Committee (PHSC) and Panel on Plant Protection Products and their Residues (PPR) are existing committees together with the European Food Safety Authority (EFSA).

C3.2.1. Plant Protection Agents Regulation 91/414/EEC

1992 the European Commission started a review process of all (active[365]) substances used in plant protection (products) on the supranational level by the "Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market". Member States are required to "prescribe that plant protection products may not be placed on the market and used in their territory unless they have authorized the product in accordance with this Directive"[366]. Today, only substances listed in the (positive-list) Annex I of the directive mentioned above are allowed to be used in the EC.

On national level each MS can choose which formulas (active substances) from the Annex I to implement in national plant protection law (but there is of course no requirement to allow these substances in the MS).

C3.2.2. Regulative Procedure for Adoption in Annex I of Council Directive 91/414/EEC

In order to attain the inclusion of an active substance in the Annex I companies have to "defend" their product proving that the "substance could be used safely regarding human health, the environment, ecotoxicology and residues in the food chain"[367], by submitting an application for the substance concerned to a Member

[363] [EU 01]
[364] Directorate General: Health & Consumer Protection, Directorate E: Food Safety: Plant health, animal health and welfare, international questions, Unit E1: Plant Health
[365] 91/414/EEC, Article 2 (4): "substances or micro-organisms including viruses, having general or specific action".
[366] 91/414/EEC, Article 3 (1)
[367] [EU 02]

State (being the "Rapporteur Member State"[368], then being the "defender" of the substance on the EC-level) together with a complete dossier, including a summary dossier demonstrating that the active substance fulfils the requirements provided for in Directive 91/414/EEC **Article 5** ("1. In the light of current scientific and technical knowledge, an active substance shall be included in Annex I […] if it may be expected that plant protection products containing the active substance will fulfil the following conditions: their residues, consequent on application consistent with good plant protection practice, do not have any harmful effects on human or animal health or on groundwater or any unacceptable influence on the environment […] their use, consequent on application consistent with good plant protection practice, does not have any harmful effects on human or animal health or any unacceptable [sic!] influence on the environment as provided for in Article 4 (1) (b) (iv) and (v)[369].") **is being fulfilled.** For the approval of a substance studies relevant to the assessment of the requirements referred to in this article are listed in the Annex II and III to Directive 91/414/EEC[370]. Summaries and results of tests and studies for each point of the data requirements for the active substance that is to be listed in Annex I have to be provided additionally to the statement of reasons why the test and study reports submitted are necessary for first inclusion of the active substance. In the Annex VI "uniform principles for evaluation and authorisation of plant protection products" are laid down.

The procedure of attaining listing in Annex I is very costly, because laborious and time consuming studies[371] have to be undertaken according to certain guidelines (EPPO-Guidelines, OECD, etc.) and high fees have to be paid to the "rapporteur" member state,[372] but therefore aims to ensure risk elimination and install certainty on active agents used in the European Community, if there were no derogation…

[368] according to 91/414/EEC, Article 6 (2)
[369] included in the Annex III, lit. b) of this paper.
[370] included in the Annex III, lit. c) of this paper.
[371] [Donat et al 2007]
[372] As learnt from the [Interview bio-ferm], the producer of Blossom Protect (a SME) had to pay AGES 145.000€ for taking over the Rapporteur-role on EC-level to attain listing in the Annex.

C3.2.3. Derogation Provision in Council Directive 91/414/EEC

"By way of derogation from Article 4" Article 8(4) 91/414/EEC a MS may authorize the placing on the market of a plant protection product which is not complying with Article 4 for a maximum period of 120 days and a limited and controlled use if such a measure appears necessary "because of an unforeseeable danger which cannot be contained by other means". The mentioned "procedure laid down in Article 19, whether and under which conditions the actions are taken by the Member State may be extended for a given period, repeated, or revoked" refers to 1999/468/EC[373] "laying down the procedures for the exercise of implementing powers conferred on the Commission".

C3.2.4. Current Legal Status of the Agents Compared

C3.2.4.1. Current Legal Situation of Streptomycin on EU Level

With the EU Commission Decision 2004/129/EC[374] the MS were obliged to withdraw the authorization for streptomycin[375] (inter alia) by latest 31.03.2004[376] the period expiring 31.12.2004 at the latest[377]. According to Article 1 of respective Decision the active substances covered by the Commission Regulation (EC) No. 1490/2002[378] (streptomycin being on the negative-list[379]) should not be included in the Annex I to the Directive 91/414/EEC: the preamble even stating clearly in paragraph (16) that "The use of anti-microbials from classes, which are or may be used in human or veterinary medicine for the purpose of plant protection should be discouraged. Two of the substances concerned by this Regulation — kasugamycin and **streptomycine** — fall into this category. Pending eventual decisions on their inclusion in Annex I, their uses should continue to be restricted and only be permitted where essential. For the purpose of their evaluation, information on anti-microbial resistance will be required".

[373] Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission (1999/468/EC), OJ L 184, 17.7.1999, p. 23

[374] Commission Decision 0f 30 January 2004 concerning the non-inclusion of certain active substances in Annex I to Council Directive 91/414/EEC and the withdrawal of authorizations for plant protection products containing these substances (notified under document number C(2004) 152); OJ L 37, 10.2.2004, p. 27

[375] 2004/129/EC, Annex I, Part B

[376] 2004/129/EC, Article 2, paragraph 1

[377] 2004/129/EC, Article 3, second sentence

[378] Commission Regulation (EC) No 1490/2002 of 14 August 2002 laying down further detailed rules for the implementation of the third stage of the programme of work referred to in Article 8(2) of Council Directive 91/414/EEC and amending Regulation (EC) No 451/2000; OJ L 224, 21.8.2002, p. 23

[379] Annex I, Part A, p. 20

Hence in the (positive-list) Annex I, streptomycin (and generally antibiotics) fails to be listed "due to missing documentation" [380]. No company[381] has taken up the research work to attain the admission (="notification process"), because it is judged to not match the requirements.[382]

Because streptomycin is now forbidden on EU-level it can furthermore only be authorized by the derogation-clause in Article 8(4) of 91/414EEC and "three-country" reports state that "in case of usage the Commission and other MS must be informed, with the Standing Committee on Food Chain and Animal Health (SCFCAH)[383] then deciding if and under which conditions the adopted measure may be prolonged by a fixed time, repeated or cancelled", but further down states that the Standing Committee has been involved and has taken note of Germany's decision (to use streptomycin in the year 2004[384], 2005[385], 2006[386] and 2007[387]).

Hence, the use of streptomycin is not allowed anymore within the EC and is regarded as highly problematic: the **Council Recommendation** of 15 November 2001 on the prudent use of antimicrobal agents in human medicine (2002/77/EC) e.g. states that the "use [of antimicrobial agents (remark by the author)] has been accompanied by an increasing prevalence of microorganisms that have acquired resistance to one or more of these, so-called 'antimicrobial resistance'. Antimicrobial resistance poses a threat to public health, may prolong the suffering of patients, increase healthcare costs and has economic implications for society"[388] and that "there is an association between the growing use of antimicrobial agents and an increase in the prevalence of micro-organisms resistant to those agents, but this relationship is clearly not a simple one. There are many possible factors influencing this relationship, including those related to the organism, to the host and to the mode of use of each drug. However, it is clear that antimicrobial resistance may not necessarily be overcome by the

[380] [DBMELV 2003], p. 18 (translated by the author)
[381] There has been one company withdrawing it's notification again in May 2003; see [DBMELV 2003], p. 14
[382] [Interview bio-ferm]
[383] Although also the Standing Committee on Plant Health is stated to be responsible.
[384] [DBVELM 2004], p. 19
[385] [DBVELM 2005], p. 22
[386] [DBVELM 2006], p. 23
[387] [DBVELM 2007], p. 25
[388] Preambel, paragraph 2; Paragraph 3 makes it more clearly: "The Council of the European Union on 8 June 1999 adopted a Resolution on antibiotic resistance entitled A strategy against the microbial threat. The Resolution highlights that antimicrobial resistance increases morbidity and mortality due to communicable diseases and leads not only to a diminution of quality of life but also to additional health and medical care costs, and that action needs to be taken at Community level."

lengthy process of continuously developing new antimicrobial compounds"[389]. Further the **Joint Research Centre of the European Commission** states that "in the last decades, an increasing dissemination of antibiotic resistant bacteria has been observed as a result of the massive and often indiscriminated use of antibiotics as therapeutic and prophylactic agents in human and veterinary medicine […]. The emergence of antibiotic resistances in previously susceptible microorganisms is rightly considered an alarming medical problem since several important human pathogens (e.g. Staphylococcus aureus, Streptococcus pneumoniae, Mycobacterium tuberculosis, […]) are becoming non-treatable with a large number of the antibiotics discovered and developed over the last sixty years."[390] Moreover it is stated that "the occurrence of resistant bacteria and antibiotic residues is reviewed and the role of horizontal gene transfer in the dissemination of resistance traits. Bacteria have not only evolved mechanisms to thwart the effect of antibiotics, but have also developed ways to disseminate to other susceptible bacteria the genetic information correlated to the resistance. […] However, the exposure to antibiotics not only selects for drug-resistant pathogens but also exerts selective pressure on the normal commensal microbiota and the horizontal transfer of resistance genes can explain the rapid dissemination of resistance from commensal to pathogenic so that the health concern for the presence of AR and MAR bacteria between environmental isolates and of VBNC cells carrying resistance traits is amplified."[391]

More scientific inputs opening a very sobering view on the threat of the agricultural use of streptomycin will be displayed further down in the chapter assessing streptomycin.

C3.2.4.2. Current Legal Situation of Blossom Protect on EU Level

In 2003[392] the exact working mechanism of BP had to be clarified to classify whether BP was a plant resistance improver or a plant protection agent (implicating the obligatory inclusion to Annex I to allow the use). It has then been classified to be an active ingredient and hence has to reach the status of being a (permitted) plant protection agent needing to be listed in Annex I of Directive 91/414/EEC.[393]

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[389] Preambel, paragraph 5
[390] [Daverio 2004], p. I
[391] [Daverio 2004], p. 32
[392] [DBMELV 2003], p. 9
[393] [Donat et al 2007]

The inclusion is attained by the evaluation of the two active ingredients isolated according to the European regulations, requiring a high extent of supporting studies. According to 91/414/EEC, Article 2 (5) BP is a "preparation" (which is a mixture or solution composed of two or more substances of which at least one is an active substance) intended for use as plant protection products and hence actually both micro-organism strains have to fulfil all the criteria listed in the

- **ANNEX II**, Part B (Requirements for the dossier to be submitted for the inclusion of an active substance in Annex I)
- **ANNEX III**, Part B (Requirements for the dossier to be submitted for the authorisation of a plant protection product)

in order to fulfil the **ANNEX V**, Part II (uniform principles for evaluation and authorisation of plant protection products containing microorganisms).

In the [Interview bio-ferm] it has been learnt, that a so-called "bringing study" (being "a very sophisticated "tox study""), was necessary to prove that these two strains "are toxicologically evaluated to be the same". This "short-cut"-possibility makes sense IMHO, since studies are mostly carried out with BP (and the product contains both strains together), being the mixture as it is released into the environment.

As for chemical plant protection products also Biological Control Agents (BCAs) need to be detected during application trials, to enable monitoring of the persistence and behaviour of the micro organisms during toxicological and environmental studies[394], which has been rather difficult, but achieved.

It is stated by Dr. Donat [Interview bio-ferm] that all the requirements (studies and dossiers) needed have been completed as per 2007 and the AGES has taken over the rapporteur status for BP in 2008. This will now lead to another (approximately) three to five years[395] waiting time for the notification-process (with Austria being the rapporteur MS) on EC-level, to complete the inclusion in Annex I of 414/91/EEC.

However the requirements for the inclusion to the Annex I positive list can be summarized as being fulfilled and hence the **risk of usage is calculable** due to existing data.

[394] [Loncaric et al 2007]
[395] [Loncaric et al 2007]; [Interview bio-ferm]

C3.3. Austrian (National) Level and Applicable Law

All the plant protection agents approved on European level can be allowed by the MS national law, but don't have to. In Austria, being the country focused in this case study, the matching piece of regulation is the Austrian Plant Protection Product Law 1997[396] (hereafter: PSMG) making specific agents becoming nationally permissible. Yet again Austria is a country consisting of nine provinces (federal states) with their individual regulations, which can on their behalf again choose independentantly to permit only selected agents that are nationally approved, resulting in nine Provincial Plant Protection Regulations.

Up to now (but according to the EU only until end of March 2009[397]) some Austrian provinces (Burgenland, Carinthia, Lower Austria, Tyrol (administrative district Lienz), Styria, Vienna)[398] are still recognized being free from E.a. (pest free area) and are hence obliged to take measures in accordance with the relevant FAO International Standard for Phytosanitary Measures[399] (ISPM's), having binding character, according to the Council Directive 2000/29EC[400] (monitoring, measures for extermination/embankment, import restrictions on host plants) and a yearly monitoring report must be sent to the European Commission. The "protected-area-status" shall protect these regions of introduction and spreading of the pest by special requirements and the loss for Austria implicates that it will also have to accept imports from tree nurseries that are not from areas of production subject to certain conditions and can no longer sustain its exemption from WTO trade rules. According to the Austrian Plant Protection Regulation (BGBl. Nr. 253/1996) plants (and plant products) of the EU that require a pass are (except one) exactly those mentioned to be host plants earlier in this paper.[401] In the EU FB is a quarantine disease, with suspicions of FB

[396] Österreichisches Pflanzenschutzmittelgesetz 1997 (BGBl. I Nr. 60/1997)

[397] COMMISSION REGULATION (EC) No 690/2008 of 4 July 2008 recognising protected zones exposed to particular plant health risks in the Community

[398] Council Directive 2002/29 EC, p. 55: ANNEX II, Part B "HARMFUL ORGANISMS WHOSE INTRODUCTION INTO, AND WHOSE SPREAD WITHIN, CERTAIN PROTECTED ZONES SHALL BE BANNED IF THEY ARE PRESENT ON CERTAIN PLANTS OR PLANT PRODUCTS"

[399] [FAO 2006]

[400] "Protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community" – obliging the APSD and FB-appointees to take and send samples from certain points (public places, orchards, private gardens, etc.) to the laboratory.

[401] The only diverging plant mentioned "Prunus" maybe ought to be seen IMHO in the light of recent observations made, that even cherry trees can suffer from FB; found in [DBMELV 2007], p. 37

being subject to obligatory registration and obligatory measures to be taken: "mechanic operations such as removal or cut-back of infested plants"[402].

Regarding the allowance of plant protection products in Austria the PSMG is the respective legal framework, committing to the minimization of risk using plant protection products on the basis of a high protection level of human, animal and environment with at the same time sufficiently securing the availability of plant protection products (§1 PSMG). This task clearly involves weighing up controversial factors such as environmental or health hazards (resulting from chemical exposure) against better protection of plants (crop).

In §3 (3) PSMG it is stated, that a new[403] active agent may only be placed on the market if the commission and the MS have received documents that are expected to fulfil the requirements of the Annex II of the Directive 91/414EEC **and** if documents according to the Annex III (= dossier) of at least one formulation (containing the active agent) have been submitted. It is furthermore stated that it is **illegal** to put an agent on the market , if there is reasonable suspicion that it is not complying with EU law, especially with the Directive 91/414EEC (see respectively §3(4) PSMG).

Upon request a plant protection agent is allowed for by an approval notification by the Federal Office for Food Safety (hereafter: BAES)[404] (§6 PSMG) if §§8-14 and §37 (9) PSMG are fulfilled. This also covers §7 PSMG (referred to in §8(1)1) PSMG providing for general admission requirement, being the implementation of the Article 3 and the very important Article 4 of the Directive 91/414EEC[405].

For the evaluation of the admission requirements the Annex VI of the Directive 91/414EEC (uniform principles for evaluation and authorisation of chemical plant protection products (Part 1) or of plant protections products containing microorganisms (Part 2)) has to be applied (mentioned in §6(2) PSMG).

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[402] [Interview AGES 01]

[403] A new active agent is not listed in Directive 91/414 and has not been placed on the market before the 26.07.1993 in a MS. This is e.g. the case for Blossom Protect – As a comparison an old active agent is also not listed, but has been placed on the market in a MS before the deadline, e.g. streptomycin. Hopefully the conclusion that this paragraph does not regulate streptomycin is wrong due to circumstances the author is not familiar with.

[404] In German: "Bundesamt für Ernährungssicherheit"

[405] §7(1)1.-5. equals the Article 4 (!) b-f of Directive 91/414 exactly

C3.4. Authorization Procedures of Agents Compared

C3.4.1. Authorization Procedure for Streptomycin

But all these requirements displayed in the previous chapter can be jettisoned by a legal backdoor stated in § 13 PSMG (being the equivalent to Article 8(4) 91/414EEC). Paragraph 1 rules that a plant protection product can be allowed for in a certain quantity and/or limited and controlled usage (taking into consideration the impacts on health of human, animal and environment) if this measure is necessary because of an unforeseen danger, which cannot be contained by any other means.

One has to criticise at this point the carelessness setting apart from the "taking into consideration the impacts on health of human, animal and environment", which has not been allowed for to an extent that would be prudent for a country wanting to safeguard its inhabitants of the danger of resistances and the problems explained earlier.

Furthermore one has to doubt if FB is still an unforeseeable danger: it has definitely been established in USA since many years and even in Germany it has been declared to be an established plant disease (mentioned in [DBMELV 2008]) that will have to be lived with, since it is not possible to be eradicated.

Moreover the derogation clause is only available if there are NO OTHER MEANS! This is not the case with FB. There are other means, as shown in this paper. IMHO it is therefore not understood why the EU tolerates these exemptions. One explanation found might be that the EU could be considered to consist of countries, which might yet again be subject to pressure from their agricultural sectors in respect to the legalisation of the agricultural use of the antibiotic.

A usage by this danger-in-delay-law is limited to four month[406] (second paragraph) and the Federal Ministry of Agriculture, Forestry, Environment and Water management (hereafter: BMLFUW) have to notify the MS and the

[406] Article 8(4) of the Directive 91/414EEC lays down a maximum period of 120 days. Please excuse the author's academic hairsplitting at this point (it is actually not relevant in regard to the allowance of streptomycin, since it will always be allowed for in spring) but it must be mentioned by the author, that in the four month period of e.g. June, July, August and September the summation of the according days would sum up to (30+31+31+30=) 122 exceeding the permitted period!

Commission (third paragraph), which can actually amend or annul this decision[407].

This begs the question why the EU still allows for the usage of streptomycin by this method, which has been explicitly banned and does not make use of its power to prohibit the use, as it has done in 2004 in Austria (unlike Germany, where it has been allowed to use): "Outdoor trials in Styria and Vorarlberg (for reasons of analysis of insertion into honey) were suggested 2004, but are lapsed, because the EU Commission has excluded a §13 admission [remark by the author: PSMG 1997] of streptomycinsulfate (information Dr. Lentsch, BMLFUW)"[408]

In the following an overview of the authorisation of streptomycin in the last five years shall be given:

2003 "Plantomycin" was not allowed in Austria and Switzerland[409] (but in Germany for 5000ha pome orchards[410]).

2004 In Germany "Plantomycin" was not available and the trade name of the plant protection agent was now "Strepto"[411] and a total amount of 5119,6 kg has been sprayed on 5653,58 ha (representing 21,54% of total pome fruit acreage in Germany) by 1409 farms[412] (the German "Bundesausschuß Gemüse und Obst – Fachgruppe Obstbau" already demanding to allow streptomycin in the following year, just as in 2004).[413] As mentioned above the EU already banned streptomycin at that time (deadline 31.03.2004), authorization in Germany 2004 was only achieved via the loophole "danger in delay". In the Austrian part of the report it says that "Plantomycin was not allowed in 2004" [414] which is simply **not true**, because during the [Interview Global 2000] it was learnt, that in 2004 the §12(10) PSMG 1997 also ruled that all Dutch authorized plant protection agents were allowed to be use in Austria (equalization rule). It was then when the

[407] Also stated in the preface of the Directive 91/414EEC: "whereas such authorization should be reviewed by the Commission in close cooperation with the MS in the framework of the Standing Committee of Plant Health" and Article 8(4) of respective directive that "it shall be decided without delay, in accordance with the procedure laid down in Article 19 [referring to Regulation 1999/468EC] whether and under which conditions the action taken by the MS may be extended for a given period, repeated, or revoked."

[408] [AGES RT 02a], p. 3

[409] [DBMELV 2003], p. 20

[410] [DBMELV 2003], p. 17

[411] [DBMELV 2004], p. 20

[412] Calculations made by the author from the provided table in [DBMELV 2004], p. 22, diverging from the numbers given in the text.

[413] [DBMELV 2004], p. 25

[414] [DBMELV 2004], p. 31

minister was required to give further details on precisely which agents would be allowed, that he referred to a Dutch homepage. Global 2000 revealed, that also Plantomycin (an agent containing streptomycin) would be allowed for free sale in Austria (actually already forbidden at EU-level), due to a clearance sale-respite for Holland. When the minister learnt about this mistake in a conference of the Austrian television station ORF[415], streptomycin was placed on a list[416] that explicitly names forbidden agents.

2005 In Germany "Plantomycin" (Company Asepta) and "Strepto" (Company Globachem" were available[417] and a total amount of 7724.56 kg was used on 9060.6 ha (representing 34.14%) by 2052 farms.[418] Having just been put on the index of forbidden agents in 2004, streptomycin was promptly authorized again in 2005: In the Austrian part of this years three-country report it is mentioned tersely with one sentence at the end of a paragraph, that "this year for the first time streptomycin had been allowed to be used by six[419] intensive orchardists" (in Vorarlberg, Western Austria), unlike in the German part, where there are tables showing exact numbers of permitted farms, applying farms, total acreage, total kg of agent used, etc. there is no such information to be found for Austria.

2006 was a "rather quiet FB-year" [420] (same in Germany) because of climatic conditions adverse to the expansion of the bacterium. Yet again streptomycin had been allowed for eight[421] intensive orchardists in Vorarlberg (Western Austria). As in the year before this information is found in one sentence at the end of a normal paragraph, again lacking any further more detailed information.

2007 was an extraordinary strong FB year in Austria (and southern Germany), with the most FB-cases since the first detection of FB in Austria 1993 according to [DBMELV 2007].[422] Under an extra header "Usage of Streptomycin" the sentence "The agent streptomycin has not been allowed against FB in Austria in the year 2007" can be found easily. The author wonders whether this format will be chosen again in 2008 (again a year of streptomycin usage) or whether it will be a

[415] in a "ZIB1" conference (the news broadcast mainly watched in Austria) according to [Interview Global 2000]
[416] "Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über das Verbot von Pflanzenschutzmitteln, die bestimmte Wirkstoffe enthalten"
[417] [DBMELV 2004], p. 20
[418] Calculations made by the author from the provided table in [DBMELV 2005], p. 24, diverging from the numbers given in the text.
[419] [DBMELV 2005]
[420] [DBMELV 2006], p. 34
[421] [DBMELV 2006], p. 35
[422] [DBMELV 2007], p. 37-39

sentence hidden in a paragraph again. The German part of the three-country report states that the streptomycin-containing products "Strepto", "Firewall 17 WP" and "Plantomycin" were allowed for this year. Further it is stated that the pest has "finally established".

2008: on March 10th the BAES (being Austria's competent authority) has authorized two products containing streptomycin ("Strepto" and "Firewall 17 WP") in Austria, although the infection pressure of FB has not been very high, but there is no final report available up to now. Still the author has found a statement by the AGES in a cooking journal [AGES K&K] that on **5700 ha** the use of streptomycin would have been allowed, but it was only used on 150 ha (2.63% thereof). The association of the Austrian Fruit Growers (Bundesobstbauverband, hereafter: BOV) speaks of approximately 200 ha pome-fruit, stated to be "only approximately 2.5 % of the Austrian pome fruit acreage".[423] The author wonders what has led to the inconsistency of data. Also in Switzerland the antibiotic was allowed for the first time until July 2008[424] and maybe the usage has to be seen as a consequence explained by Dr. Burtscher in [Interview Global 2000] that the change of the legal situation ruling that infected trees would not have to be cleared against the will of the owner, led to a "higher infection pressure, therefore higher risk for orchardists, which has led to making the position worse of those being in favour for consequently pruning their trees instead of using antibiotics and might also explain the allowance of streptomycin in Switzerland in 2008."

Restrictions

The authorization is subject to certain **conditions** such as the application only being allowed for full-time[425] orchardists involved in intensive pome-fruit-growing, for a maximum of three sprayings during blossom time of pome fruit (apple, pear, quince and medlar trees) and only after a warning by the installed weather forecasting system has been given.[426]

C3.4.2. Authorization Procedure for Blossom Protect

In some countries (as for example in Austria, Germany Slovak Republic, Hungary, Slovenia) this product has also been given "danger-in-delay" (emergency-

[423] [BOV HP]
[424] [lawa 2008], p. 15; [CH 2008]
[425] The orchard being the (main?) income source.
[426] [BAES 04]

permission) in the last years, just as is the case with streptomycin. The notification process on EU-level has started and the inclusion in the Annex I is only a matter of time.

Peculiarity of Austrian Law

Besides plant protection products, which have been described earlier in this paper, also "plant (health) auxiliary agents"[427] are available on the market, which are "substances without substantive nutrient content, determined to have some effect on plants, raise their robustness or influence the processing of organic substances". The Austrian Fertilizer Law 1994 and the corresponding Austrian Fertilizer Regulation 2004 regulate these agents, but no EU-wide regulation covers these products.[428] In the respective laws authorized substances are listed (for products regulated within these laws), and can be marketed (in compliance with potential further conditions) without further formal act.

As a peculiarity it is learnt, there is an exception to these legal provisions: Germany provides a list of authorized "plant strengtheners" (which can be seen to be a loop-hole from the EU Directive 91/414/EEC). According to current law the multitude of listed plant strengtheners in Germany are likewise allowed to be used in Austria. In the annex of the Austrian Fertilizer Law (section "12. Pflanzenhilfsmittel") these are by law plant auxiliary agents despite Austrian authorization rules. The only condition being that no plant protection effect is advertised.[429]

Being on this list BP the product actually has a legal authorization as a **"plant strengthener"** and is actually **allowed to be placed on the market freely in Austria** at the moment, but this arrangement will only remain upright as long as it is furthermore tolerated by the MS of the EC. For this reason, apart from the derogation clause possibility BP is also allowed to be sold as such a plant strengthener in Austria entailing the disadvantage that the promotion of its efficiency against FB is not allowed. Dr. Donat states at the [Interview bio-ferm] that **"**BP has been on the **IP-list**[430] and also on the list for **organic farming** during the danger-in-delay authorization period" meaning that in these phases it is allowed to communicate on the fact that BP is a pest control for FB.

[427] Orginal term in German: "Pflanzenhilfsmittel"
[428] According to Wernitznig, F. and Kohl, J. from the AGES in [BOV 5_2008], p.16
[429] Stated in [BOV 5_2008], p.15 et seq.
[430] Corresponding documents for 2008 are [ÖPUL 03_2008] and [ÖPUL 05_2008]

C4. Assessment of Streptomycin

C4.1. Direct Costs of Spraying Streptomycin

The company Globachem, producer of "Strepto" has not replied to the emails of the author. Since the online search for other information sources available has led to an average price of more than double the price stated in a document of the relevant Swiss governmental institution, the calculation of an averaged price per kilo of agricultural streptomycinsulfate has only been set aside by the author. It is assumed that the prices found[431] relate to medical and not agricultural streptomycin (surely requiring a much higher standard) or have not been subject to the price reduction that a bundled order by all pome-fruit growers of a country (in which the product is allowed) can achieve. The Swiss price found, can be assumed to apply to all Swiss farmers[432] and has served as the information base in this case study, until eventually, shortly before the completion of the case study the author was able to retrieve a price of streptomycin applying to the Austrian farmers in 2008 that will be used for the calculations in this paper.

As can be seen from the table below the price retrieved on the Austrian streptomycin does not include the company, concentration data etc, but it is strongly suspected that it is actually the same product, but no more detailed information is provided.

Table 9: Median Price per kg of Streptomycin in EUR

Price Information Streptomycin	Switzerland	Austria[433]
Company	Schneiter Agro AG (CH)	?
Product trade name	Strepto	"Streptomycin"
Content of Streptomycinsulfate (%)	21.6%[434]	?
Content of Streptomycinsulfate (g)	180g/kg	?
Quantity needed for 1 ha	600g	600g
Dilution %	0.0375	?
Efficiency	70-90%	?
Unit Quantity	600g	?
Unit Price	145.00[435]	?
Cur.	CHF	EUR
EUR/kg	156.52	130.00
Costs per ha, per treatment in €	93.91€[436]	78.00€

[431] E.g. [Sciencelab.com]; [MP Biomedicals P]; [Invitrogen]; [Chemicalland21]
[432] [lawa 2008]
[433] According to a calculation of Dr. Steinbauer (Styrian Provincial Government): [Steinbauer Prices]
[434] [lawa 2008], p. 15-21; [BAES 04]
[435] [lawa 2008], p. 21
[436] 600g package unit is for 1 ha, 600g cost 145 Swiss franc as stated in [lawa 2008], p. 21); 145.00 CHF equal 93,91 EUR.

Price Information Streptomycin (continued)	Switzerland	Austria[437]
Annual costs per ha (3 treatments)	281.73€	**234.00€**
Further remarks	"sale in Germany since 2004, in Austria since 2006" [438]	Price for Austrian farmers in 2008

As the Austrian governmental notice allows for a maximum of three oversprays per year, the costs will be calculated assuming these three possible spraying to achieve the highest possible efficiency grade resulting in annual total plant protection cost of 234.00 € per hectare. In Switzerland "gun-applications" are not allowed[439], whereas in Austria they seem to be allowed.[440]

Further the costs of spraying streptomycin include the use of equipment and working time. The calculation retrieved from the Styrian Government by Dr. Steinbauer [Steinbauer Spraying Costs] has assessed these costs to be follows:

Table 10: Cost of Spraying Streptomycin; Source: [Steinbauer Spraying Costs]

	Cost/h	hours/ha	Cost/ha	Total/ha	Total/ha/year
Material costs					
(Orcharding) Tractor, 4WD, 50 KW	40.12€	0.75	30.09€		
Spraying equipment ("30.000 m3, 550 lt")	15.36€	0.75	11.52€		
				41.61€	3 x 41.61 = **124.83**
Working costs	12.00€	0.75	9.00€	9.00€	3 x 9.00 = **27.00**
Total per application				50.61€	**151.83€**

These costs are accumulative to the costs for the spraying agent itself aggregating to annual costs of **385.83€/ha/year** (151.83 + 234.00) for protecting one hectare of the orchard so far.

In [Steinbauer Spraying Costs] furthermore inspection rounds are mentioned as matter of expenses (two working hours, 2x12€). It is understood by the author to be a voluntary action (because it cannot be found to be a requirement in the "authorized conditions of use" of streptomycin (issued in [BAES 04]). Since monitoring the orchard closely during springtime is a quite necessary action anyway to (as described earlier) discover contingent infections of FB, these costs are omitted in the following Cost Benefit Analysis (CBA).

[437] According to a calculation of Dr. Steinbauer (Styrian Provincial Government): [Steinbauer Prices]
[438] [lawa 2008], p. 21: "excl. postage fees"
[439] [lawa 2008], p. 15
[440] [BAES 04]: "Method: Spritzen oder spruhen"

Furthermore the plant protection agent needs to be diluted in **water**. In [BAES 04] it is stated, that 1000 litres are needed per ha. These costs are omitted in both scenarios (streptomycin and Blossom Protect), for following reasons:

1.) water prices are not the same all over Austria, but vary between municipalities;

2.) the total amount of water needed is stated to be the same in both scenarios ([bio-ferm 04]: 500 litres for 1 m crown height, 1000 litres for 2 m crown height respectively[441]);

3.) these costs were not included in [Steinbauer Spraying Costs], and the reasons for this might be that farmers very often have wells they therefore do not use water from a public source. The costs in St. Florian, Upper Austria, for water would be: 1.40€/m^3 obtainment-costs and 3.28€/m^3 sewage system fees, in total 4.68€/m^3 (excl. VAT).

Required Personal Protective Equipment includes chemical goggles (or shielded safety glasses), Emergency eye-wash, Chemical-resistant long-sleeved shirt, trousers, socks, shoes, gloves, Emergency water shower, approved air-purifying respirator approved against pesticides.[442] Also these costs were not included in the price calculation retrieved from the Styrian Government by Dr. Steinbauer and since the author has found it very hard to obtain these costs, they are omitted in both scenarios (streptomycin and Blossom Protect), but can easily be incorporated by experts, recalculating this CBA.

The mowing goods or crops of **cultured plants underneath** are forbidden to be used for animal feed. Additionally blooming cultures must be eliminated before each (!) treatment (probably in order to restrict the probability of bees coming into contact with contaminated flowers) and must be mowed or mulched.[443] These costs therefore result in additional mowing costs (working time and material/equipment cost) or the lost profit for selling/using the cultured plants (e.g. hay). Whereas the lost profit for these cultures is found hard to estimate by the author (due to lacking market expertise), the additional material and working costs are tried to generate according to the calculation of [Steinbauer Spraying Costs]: it can be assumed, that for mowing a tractor is needed (costing

[441] Also e.g. in [ÖPUL 01_2008] the basis for calculations in Austria is stated to be 1000 litres per ha and a crown height of two metres.
[442] E.g. [lawa 2008], but also [Nufarm]; [Farm$aver]
[443] [BAES 04]: "Other conditions and particulars"

40.12€/h), and further that it can be worked with the same velocity as with spraying (0,75h/ha), and the working costs are equal to spraying, too (this is also underpinned by the same costs calculated for inspection rounds). If the author's assumptions are correct, this would result in additional mowing costs of 39.09€/ha per spraying. The three sprayings allowed therefore amount to additional costs of **117.27€/ha**.

Table 11: Additional Mowing Costs; Source: based on [Steinbauer Spraying Costs]

	costs/h	hours/ha	costs/ha
Material costs			
Tractor, 4WD, 50 KW	40.12€	0.75	30.09€
Working costs	12.00€	0.75	9.00€
Total per application			39.09€
	for 3 applications		**117.27€**

C4.2. Indirect Costs and External Effects

C4.2.1. General Side Effects of Streptomycin

It is a fact that the following reactions (side-effects of streptomycin on humans) are "common"[444] "vestibular and auditory damage"[445] (ototoxity[446], naussea[447] causing vomiting, vertigo), nephrotoxity[448] (amongst other problems with nerves[449] and allergies)[450]. Special precautions are to be taken with infants, children[451], pregnant[452], breastfeeding women and elderly[453]. It is also stated that "long-term exposure might cause fertility problems in the female"[454]. [Kastanioudakis et al 1993] e.g. report "hearing loss and vestibular dysfunction in childhood from the use of streptomycin in Albania."

[444] [RXMED]
[445] [WHO 02]
[446] [ENIUS]; [Wikipedia 02]; [VN]; [Gideononline]; [Drugs Pro]: "Both vestibular and auditory dysfunction can follow the administration of Streptomycin. The degree of impairment is directly proportional to the dose and duration of Streptomycin administration, to the age of the patient, to the level of renal function and to the amount of underlying existing auditory dysfunction."; [RXMED]: "Loss of hearing has been reported following long-term therapy."
[447] [ENIUS]; [Drugs Pro]
[448] [ENIUS]; [Wikipedia 03]; [VN]
[449] [VN]
[450] Also listed on [Nufarm], a label of an agriculturally used streptomycin product.
[451] See the study of [Kastanioudakis 1993]
[452] [Drug Pro]
[453] [WHO 02]; [Drug Pro]: "Streptomycin can cause fetal harm." [RXMED]: "Since streptomycin readily crosses the placental barrier, caution in use of the drug is important to prevent ototoxicity in the fetus."
[454] [Eggcentris]

However, streptomycin is not effective when orally taken and is therefore administered by intramuscular injection in medication, because it is "not absorbed from the gastrointestinal tract when given orally"[455]. A typical adult dosage would be 1g of streptomycin sulphate by deep intramuscular injection[456]. Patients over 60 years or patients weighing less than 50 kg may not tolerate doses above 500–750 mg daily[457].

"At present there is **no binding limit value regarding human health available** for long-term exposure or exposure at application" is stated by [AGES 18][458]. However even if available these studies should be viewed with some reservations, e.g. the stated "acute toxity" (measured by the lethal dose) etc. "does not reveal anything useful" according to Prof. Pittner, arguing that the values "says that 50% of the rats die at a certain level of intake. But rats have a completely different metabolism as humans and there is no data concerning other physiological damages, as e.g. providing information on allergies induced."

C4.2.1.1. Resulting Handling Risks

The following section addresses the possible hazards streptomycin may have on individuals handling streptomycin at the process of spraying.

An argument has to be introduced at this point, bearing in mind that, according to Prof. Pittner synergies arise here: even if not effective when orally given the antibiotic is leading to resistance, on interaction with the human body and can cause allergies, etc..

In the document [EPA streptomycin] it is stated that after conducting a review process of incidents reports there were "relatively few reports of ill effects from exposure to streptomycin"[459] and workers are therefore recommended to use skin and eye protection and should be protected from "drift or other residue after application".[460] The findings of the EPA on spraying accidents must be seen in the light of the fact that streptomycin is not metabolised orally, but antibiotic resistances build up unnoticed in these individuals not having a direct effect, until an infection strikes the individual necessitating antibiotic cure.

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[455] [RXMED]
[456] [Gideononline]; [WHO 02]
[457] [WHO 02]
[458] [AGES 18], p. 2 (translated by the author)
[459] [EPA streptomycin], p. 4
[460] [EPA streptomycin], p. 4

Risk / Cost Rating:

Thus on the whole the risk hazardous health exposure at spraying and the risk of spraying accidents is judged **not too high**[461] in respect to observable body reactions (such as skin rashes, allergies, etc.) but **high** in terms of breeding antibiotic resistance inside the individuals handling the product.

C4.2.2. Antimicrobial-Resistant (AMR) Bacteria

Resistances occur by mutation in rpsL (gene for S12 ribosomal protein), that prevents binding of streptomycin to ribosome[462], "meaning that the bacteria gain the ability to generate a resistance against antibiotics in that they change their metabolisms either in degrading the antibiotics or establishing metabolic mechanisms to expel them when the antibiotics penetrate the cells."[463]

As with other antibiotics, the use of streptomycin may result in overgrowth of non-susceptible organisms, including fungi,[464] because "surviving microorganisms can use biocide molecules as an energy source and nutrient source"[465].

The problem of development of resistant strains occurs within agricultural as well as within medical applications.[466] [McManus] states that "low doses of antibiotics applied to large areas over long periods of time contribute to the build-up of resistance in clinical bacteria".

[461] In the [Interview Global 2000] Dr. Burtscher e.g. states, that "[c]ompared to other pesticides, the problem with streptomycin is not so much a problem because of the direct health reasons of farmers working with it […]" (but then refers to the severe health risks interlinked with antibiotic resistance (to be discussed further down).

[462] [MP Biomedicals]

[463] [Interview Pittner]

[464] [Drug Pro]; [RXMED], [Interview Pittner]

[465] [Badalucco et al 1994], p. 334

[466] [Interview Pittner]; [Primaryinfo];

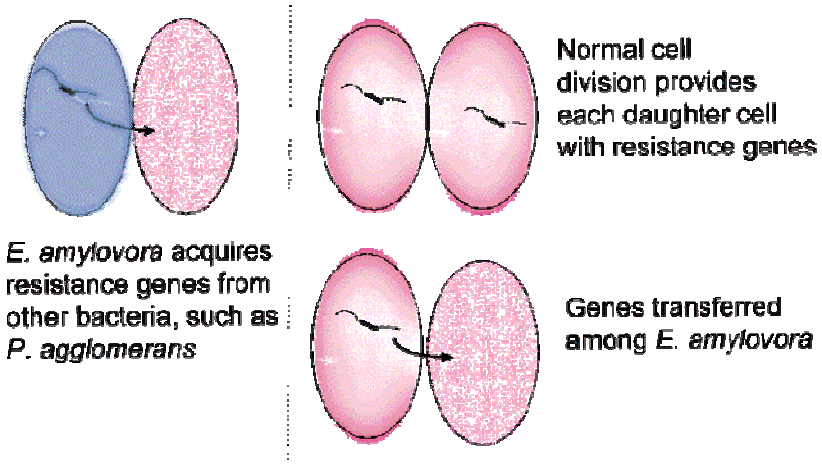

Figure 5: Resistance gene transfer; Source: [McManus]

With streptomycin bacterial resistance develops rapidly (compared to other antibiotics)[467] and [McManus] also identifies another problem that even "reagent and veterinary formulations of antibiotics have been found to contain antibiotic resistance genes" and is sceptical about higher purity of antibiotics used for plants posing the question whether the antibiotics used could "themselves be an origin of antibiotic-resistance genes in agroecosystems?".

C4.2.2.1. Agricultural Risks

Professor Pittner argues that as far as agriculture is concerned the usage of streptomycin is a problem, because the antibiotic does not only kill the bacteria causing FB, but also bacteria in the surroundings (air, soil). Whereas the substance is well-balanced through evolution in its places of natural existence (e.g. in the soil of forests), it is now sprayed on blossoms, leaves, branches and tree-trunks where it does not occur naturally there is no longer such a balance (besides the differing natural quantity).

It is a fact that strains of the pathogen E.a., resistant to streptomycin, are already present in some orchards in eastern U.S.[468], they are also widespread in most apple and pear regions of western U.S.[469], New Zealand and Israel:[470] "However the bacterium has developed resistance to streptomycin in several states [...]. Thus streptomycin is losing its effectiveness."[471]

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[467] [Interview Pittner]
[468] [Wilcox]
[469] [Wilcox]
[470] [McManus]; [Manulis 1998]
[471] [Cornell University et al 2003], p. 10

The threat for agriculture lies within the establishment of resistant FB bacteria, leading to the impossibility to plant pome fruit.

Figure 6: The stars indicate regions with streptomycin-resistant Erwinia amylovora; Source: [McManus]

In the following, parts of the interview with Prof. Pittner on the risks associated with the agricultural use of streptomycin shall be stated[472]: "Streptomyces species naturally occur in soil and use streptomycin to compete with other microorganisms. But if streptomycin comes into soil in high doses because of spraying, then this can in the long run lead to massive imbalances of the composition of the microflora of the soil. Furthermore the streptomycin resistant bacteria (the ones surviving the streptomycin-attack) can use streptomycin available (but not harmful to them anymore) as a carbon-source (energy), even pushing growth of resistant and insusceptible bacteria.

Streptomycin is water-soluble and penetrates the soil with rain. The result may be that these soils cannot be used as cropland anymore and are turned into devastated areas. It will lead to a similar situation as experienced in many regions in U.S. where it is already impossible to grow plants belonging to the family of rosacea.

Because we have not scientifically observed yet, what happens, if we disturb the balance (equilibrium) in the soil, this can lead to incalculable damages: unknown damages of the ecosystem will have to be faced for sure, insecure is only the extent of the risk taken."

[472] For the whole Interview please refer to [Interview Pittner] in the Annex

Responding to the interjection of the author, that the arguments of protagonists of the agricultural use of streptomycin often ward off this threat emphasizing the limited application, Prof. Pittner states, that "exactly this kind of use produces resistances!" explaining this by a striking comparison: "If in human medication antibiotica have to be prescribed, it must be a dosis to surely kill ALL the bacteria, so that no resistances build up, and you will be warned to take all the pills, and not to stop until the packet is finished, even if you feel better already."

The argument of the BOV[473] stating that "a comparison of the American usage modalities is not admissible" (because in America streptomycin can be sprayed more often than 4 times and has been sprayed much longer than in Europe) in view of the resistances-problem, is therefore **proved wrong**. Furthermore [Pesata 2008] states that "for the usage as a plant protection agent Streptomicin [Remark by the author: SIC!] must be imported; AGES reckons an amount of up to 10.000 kilogram"[474].

Risk / Cost Rating

Due to the emergence of strains of E.a. resistant to antibiotics, it is **only a delaying strategy** and other instruments will have to be found to keep the danger of infection in the affected orchards at a tolerable level and further entails **severe risks** for society as a whole (as shown in the next chapter).

C4.2.2.2. Human Health Risks

Antibiotics are an important and widely used medical intervention preventing "incalculable suffering and death".[475] But bacterial adaptation and resistance cause a "struggle to stay one step ahead of pathogens […]" and the "rise of multidrug resistance and the ready transfer of resistant traits among pathogens require heightened action if we are to prevent increasing outbreaks of infections that become more difficult, or even impossible, to treat." Also [Heilig et al 2002] claims that subtherapeutic doses are worrisome because "they seem to provide ideal environments for the selection of resistant pathogens."

This is what the World Health Organisation (WHO) states about antibiotic resistance: According to Dr. Gro Harlem Brundtland (WHO Director-General) we ought to protect the effectiveness of antibiotics, otherwise "we could be heading

[473] In [BOV 5_2008], p. 3 (translated by the author)
[474] [Pesata 2008], p.51 (translated by the author)
[475] [Heilig et al 2002]

for a post-antibiotic age in which many medical and surgical advances could be undermined by the risk of incurable infection." Life saving discoveries made by medical science (and the adherent investments – stated to be US$ 17 billion between 1996 and 2001) is at risk due to growing threats of drug resistance. Further the WHO states: "Drug resistance is a natural biological occurrence, but one that can kill." Moreover, it is remarked, that drug resistance is spreading fast and corresponding drugs are becoming ineffective. An example is given: "[…] in several countries strains of tuberculosis have become resistant to at least two of the most effective drugs used against the disease." And further: "It is a global problem. **No country can afford to ignore it, no country can afford not to respond.** At the same time, action taken in any one country will have clear and positive results around the world."[476]

Also [Angula et al 2004] postulate that "[c]linicians should be aware that antimicrobial resistance is increasing in food-borne pathogens and that patients who are taking antimicrobial agents […] are at increased risk for acquiring antimicrobial-resistant food-borne infections."

[Shea 2003] states that "[a]ntimicrobial resistance has reached crisis stage in human medicine. The rapid acceleration of multidrug-resistant bacteria in the past 2 decades has overtaken new drug development, and patients and clinicians are faced with the prospect of untreatable infections. Although much of the problem stems from overuse and misuse of antimicrobial agents in human medicine, **large-scale use of antimicrobials in agriculture also contributes to the crisis**. Agricultural uses of antibiotics produce environmental exposures in a variety of reservoirs, which select for resistant microbes and microbial genes." In her article she documents evidence on human health risks as a consequence thereof to provide background knowledge and necessary evidence to "advocate for judicious use of antimicrobials in all sectors."[477]

All these warnings should be considered in combination with the annual report of the European Centre for Disease Prevention and Control (ECDC) on Diseases in the EU and EEA/EFTA countries.[478]

Questioned for his opinion on the health risks for humans, Dr. Burtscher from the NGO "Global 2000" also warns of "[…] emerging resistances (against antibiotics

[476] [WHO 01] (emphasis by the author)
[477] Emphasis by the author
[478] [ECDC 2007]

used in medicine for humans) and the interchange of resistances" and further claims that a ban in Europe "was a great success", now "carelessly jeopardized by the Austrian danger-in-delay-admission" stated to be "bursting of a dam" (again).[479]

Prof. Pittner states that "[t]he dangerousness of the agricultural use of streptomycin is not assessable today, because there is no binding[480] data available. The "hazardous substance labelling" is "unknown" for streptomycin. This does not mean that there is no danger, but on the contrary we do not know anything about them up to now. This bears a high risk!"[481]

A) The Risk of Streptomycin-Resistant Bacteria

Due to the adverse side effects of streptomycin (already shown), it is only subject to limited[482] use in human medicine nowadays: according to [Oberdisse et al 2002] mainly for the treatment of so-called "problem germs" if other antibiotics (due to resistances or incompatibility) cannot be used and names as one of the main indications (still) the treatment of tuberculosis (together with other antituberculotica). Prof. Pittner refers to an imminent threat linked to the resistances caused due to the fact that tuberculosis is not banned, but is introduced from Eastern Europe. These tuberculosis bacteria, are stated by Prof. Pittner to be "highly resistant against antibiotics, are moving towards our latitudes, against which our common antibiotic medication is already without effect. Furthermore in central Europe tuberculosis has no longer been inoculated against because it has been perceived to be extinct. This problem can **lead to deaths** because there is no treatment available!"

B) Cross-Resistances

A report of the [Cornell University et al 2003] states that there are "[…] concerns that antibiotic resistance in Erwinia amylovora could spread to other bacteria that infect humans." [483]

An article rated to be very important by Prof. Pittner is [Sundin et al 1996], pointing out the **threat of antibiotic resistance gene transfer**:

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[479] [Interview Global 2000]
[480] Found to be stated e.g. in [AGES 18], p. 2
[481] Please also refer to the Annex III d) of the case study, showing how many times "n.a." (no information available" is stated for streptomycin.
[482] [Pesata 2008]; [Sundin et al 1996], p. 133; [VN]
[483] [Cornell University et al 2003], p. 10

"Gene transfer within bacterial communities has been recognized as a major contributor in the recent evolution of antibiotic resistance on a global scale."[484] Research conclusions have revealed that similar antibiotic resistance gene sequences may be present in unrelated organisms suggesting that these sequences are accessible from a microbial gene pool (having facilitated their rapid dissemination into a wide variety of organisms).

"The linked strA-strB genes, which encode streptomycin-inactivating enzymes, are distributed worldwide and confer streptomycin resistance in at least 17 genera of gram-negative bacteria. The wide distribution of the strA-strB genes in the environment suggests that gene transfer events between human, animal, and plant-associated bacteria have occurred." And a "large body of evidence suggests that transfer of strA-strB among unrelated bacteria in the environment has occurred recently."[485]

Evidence for gene transfer between distantly related species is not only describing the antibiotic resistance problem in clinical bacteria, but is expanded by the use in both animal husbandry and plant disease control.

Also Sundin (just as Prof. Pittner) argues that the "utilization of antibiotics in these agricultural applications directly affects the ecology of bacterial populations at the target sites" resulting in the dissemination of antibiotic resistance bacteria (or determinants) into additional environmental niches which may likewise alter the ecological interactions in communities which were not subjected to antibiotic exposure.[486]

The threat of **cross-resistances** must be feared following from Sundin's finding that "In bacterial isolates from humans and animals, strA-strB are often linked with the sulII sulfonamide-resistance gene"[487] - with sulfonamides being an important class of antibiotics needed in medicine.[488]

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[484] [Sundin et al 1996], p. 133
[485] [Sundin et al 1996], p. 133 et seq.
[486] [Sundin et al 1996], p. 134
[487] [Sundin et al 1996], p. 133
[488] [Sundin et al 1996] states that "[t]he societal and epidemiological risk factors involved in the persistence of Abr genes in clinical bacteria have been detailed in": Cohen, M.L. (1992) Epidemiology of drug resistance: implications for a post-antimicrobial era. Science, 257, p. 1050-1055.

Further the **group of aminoglykosides,** which streptomycin belongs to, is stated to show **partial cross resistances** among each other.[489]

C) Allergies and other Risks

Prof. Pittner explains the following: "Concerning allergies, for example, it has been known for a long time, that people having much contact with soil have a better immune-response due to actions caused by the microflora. However this triggering of the immune-system may also result in overreactions of the body: i.e. allergies.

If streptomycin is now found to be in places (drinking water, air, trees) where evolution has not been able to counterbalance its existence (as explained in the previous question) it cannot be decomposed. But also in its natural environment soil the microflora is changed due to its impact leading to imbalances. Because of this reason streptomycin is also a strong allergen."

At the same time one must bear in mind, that agents causing health risks to us, will also have a similar impact on animals. Especially people involved in animal husbandry ought to consider, that the growing problem of resistance might affect their animals if more and more medicine will no longer be able to assist and cure bacterial infections.

Total Risk / Cost Rating

The need to preserve the efficacy and supply of antibiotics (by an appropriate use of antimicrobial agents) is therefore rated to be **crucial**[490] by the author.

The threat to human health **is judged to be very high** and has to be seen in connection with the findings of the following paragraph:

C4.2.3. Displacement of Streptomycin

C4.2.3.1. Dispersion of Resistances and Allergies

Prof. Pittner states that "[s]treptomycin is no reactive substance, not decomposing right away. It needs to be broken down by microorganisms." As explained above, streptomycin is now found on ecological niches it is not normally found in. Prof. Pittner therefore argues, that if these microorganisms (braking

[489] [Oberdisse et al 2002], p. 662
[490] Supported by [Heilig et al 2002]: comparably rating it as "crucial"

down streptomycin) are missing, the substance "can disseminate in the environment through wind, rain etc." Because of its water solubility it can reach the ground-water (e.g. washed out with rain). If streptomycin finds its way into water, it can remain there virtually forever. The Professor of Biochemistry at the University of Vienna argues: "If we then drink water containing streptomycin, certainly the interaction on the metabolism of the human body is not the problem, but it has all the other negative impacts explained before (e.g. allergies). Additionally, by consuming water and food (e.g. honey), which have been contaminated by antibiotics and by spraying it into the environment, we are breeding streptomycin-resistant bacteria so that we have no defence against them anymore. If resistant bacteria afflict us the antibiotics streptomycin will not help us anymore."

C4.2.3.2. Ecotoxity

Even in the Austrian notification for the authorization of streptomycin it is stated that it is "toxic for aquatic organisms and can have long-term damaging effects on lakes and rivers".[491] For this reason the spraying of streptomycin is only allowed at a distance of 20m.[492] A producer states that "streptomycin is toxic to algae and fish prey organisms"[493] and also in the Austrian streptomycin assessment document [AGES 18] it is stated, that it may be toxic to rainworms and certain algae. Thus some sources refer to the risk of displacement of streptomycin by rain into ground water and surface water, thereby harming small organisms and fish, which could lead to reduced fertilization of these.[494]

Mr. Zainer from the Environmental Institute states that soil and water samples of treated areas show no residues, but grass samples under treated trees showed residues for several weeks.[495] But the same Institute did not, however, detect residues in apples, which were later on shown to be there (outlined in the following chapter).

[491] [BAES 04] (translated by the author)
[492] [BAES 04]
[493] [lawa 2008], p. 18 (translated by the author)
[494] E.g. [VN]
[495] [ORF 03]

C4.2.4. Residues of Streptomycin in Food

C4.2.4.1. The Legal Situation on Maximum Residue Limits in Honey

The antibiotic can be sprayed at blossom time during different stages of open blossom, which has been allowed for a maximum of three times in Austria. As it is claimed that streptomycin is metabolised until the harvest of the apple, honeybees cannot be kept from collecting honey from recently sprayed blossoms and can therefore collect honeydew contaminated with streptomycin. Because streptomycin is water-soluble there is the risk of its displacement in honey.

For antibiotic residues in honey the EU Regulation 2377/90 did not define maximum residue limits. Austrian law (the same as German law[496]) defined this level to be 20 µg/kg for streptomycin in honey in the "Vermin Remedy Peak Values Regulation"[497]. In order to protect consumer health the EU has regulated that the maximum tolerable streptomycin residue in honey must be below 10 µg/kg (regulated in the Annexes of the EU-regulation 396/2005) from 1st of September 2008 on[498].

C4.2.4.2. Costs of Preventing the Sale of Contaminated Honey

How high are the costs accompanying the agricultural usage of streptomycin regarding the possible content of honey and the adherent measures to prevent the fact that these contaminated products are marketed?

Monitoring / Laboratory testing: it is stated by the Styrian "Imkerbund"-Chairman Mr. Josef Ulz that in order to make sure that no contaminated honey is marketed, monitoring by the (Styrian) provincial government of the beekeeper-organisations has been organized, surveying all affected locations of bee-hives.[499] If streptomycin is used "AGES calculates how many bee-hives are in the region and how many samples have to be taken" [500]. Ulz even states that honey will be taken off the market if residues are tested positively in honey, regardless of regulated residue limits , because only residue-free honey shall be passed on to consumers (standing in for the so-called zero tolerance). Real "zero"-contamination though is technically not feasible: the testing on residues of streptomycin in honey has a detection limit (being the value above which with a

[496] [DBMELV 2003], p. 11
[497] In German: "Schädlingsbekämpfungsmittel- Höchstwerte-Verordnung BGBl 2002/441"
[498] [AGES 09]
[499] [APA 09052008]; [Interview ÖIB]
[500] [Interview ÖIB]

certain significance level it can be determined whether a certain substance is existent within a sample or not), hence there is an operative restriction due to technical feasibility.[501] There is a certain risk of wasting non-contaminated honey due to test failures, but the author cannot estimate that. For cost and time efficient testing, a two-step procedure is recommended[502]:

1. Screening ("ELISA", "CHARM II", etc.) to find possible positive results: (state of the art) screenings are stated to have a detection limit at 5 µg/kg;

2. Verification analysis for non-negative results by chromatographic methods.[503]

The price for a screening-test at AGES (competence centre for veterinary medicine and hormones) is stated to be 75.00 € excl. VAT.[504]

C4.2.4.3. Costs of Contaminated Honey (incl. Disposal)

Also if beekeepers do not suffer financial damage because costs are covered by the government (as for example the Styrian provincial government has decided), the honey is actually produced to be sold, but further economic damage could be derived due to the risk that costumers move on to other sources.

The median price (calculation by the author) of the most common honeys listed in [ÖIZ] is 8,72 €/kg incl. VAT[505], hence 7, 93 €/kg excl. VAT, representing the real market value of honey according to the following calculation by the author:

Table 12: Median Price of Honey per Kilo; Source: calculated by the author from Quotation [ÖIZ], p.12 et subs.

		€/kg incl. 10% VAT	€/kg excl. VAT
1	Forrest honey ("Waldhonig"):	9,20	8,36
2	Basswood honey ("Lindenhonig"):	8,70	7,91
3	Cream honey ("Cremehonig"):	8,70	7,91
4	Blossom honey ("Blütenhonig"):	8,30	7,55
5	Acacia honey ("Akazienhonig"):	8,70	7,91
	Median Price of Honey per Kilo:	8,72	**7,93**

"The kg honey is worth 7.50€/kg (on average)" is stated by Mr. Ulz (Chairman of the Beekeepers Association in Austria) in [Interview ÖIB]. According to the

[501] [AGES 07], p. 6 et seq.
[502] [AGES 09], p. 1
[503] [AGES 08], p. 1; The interested reader might find the article of [Bruijnsvoort et al 2004], [Edder et al 1999], [Gaudin et al 2004] and [Ye et al 2007] worth reading.
[504] [AGES 08], p. 2
[505] [ÖIZ], p. 25

Austrian Statistics Office[506] the producer price of honey per kg is 5.98 €. But since not only the actual costs of producing honey are lost, but also the profit margin, the (market-) price stated by Mr. Ulz should be taken in consideration.[507]

The provinces have taken over these compensation payments (being a provincial matter). Mr. Liedlbauer (from the Upper Austrian Beekeeper association) has forwarded the respective agreement with Upper Austria[508] to the author, stating that the beekeepers will be compensated for the costs[509] of testing the honey-samples from risk zones (a three km radius of the spraying area) amounting up to €75.00 and that in case of contamination the honey will be **bought up for €5.00**. The agreement, although never signed, has been upheld according to the information of Mr. Liedlbauer. But it must be remarked, that this has been IMHO a very unsure status that is actually unacceptable in this economically damaging situation, originally provoked by governmental interference (by authorizing streptomycin).

According to a telephone call with Mr. Fröhlich[510] from the company "Linz AG", department of Waste Management (Upper Austria), the following information has been given to the author: honey can be disposed of in normal residual waste containing up to 25% (!) of antibiotics (but according to a paragraph in the Waste Management Law it is not allowed to obtain this percentage by dilution). This is astounding when one considers the hazards of developing resistances! It is clear that a failure to regulate has been found (and therefore discussed outright). A regrettable peculiarity of inflexibility and regulation by environmental standards completely missing the actual issues can be observed in connection with the information on Blossom Protect. BP being actually a totally harmless substance, it nevertheless has to be disposed of as special waste[511], simply because it is a plant protection agent, without regard to its actual toxity, although "nobody would dispose baker's yeast as special waste"[512] under normal circumstances, as Dr. Donat remarks, on the other hand it is allowed to discard antibiotics in normal residual waste! The costs for residual waste were obtained from Mr. Glasner (also

[506] [Statistik Austria 2007 agriculture], p. 126-131: Agricultural and Forrestry Producer Prices 2007, Annual Average for Austria in Euro (excl. VAT) (translated by the author)

[507] [Brent 1991], p. 13: "Costs are usually measured in market prices".

[508] Although the agreement says "signatures" naming "LR Dr. Stockinger, LKÖ-Präsident, Ing. Schiefermüller (Erwerbs-Obstbau), OÖ. Landesverband für Bienenzucht" at the bottom.

[509] As stated in [Interview OÖLVB] the Upper Austrian beekeepers have purchase their own analysation instrument for testing on streptomycin.

[510] After speaking to Mr. DI Singer from the Landesabfallverwertungsunternehmen (LAFU) in Wels, Austria

[511] [Interview bio-ferm]

[512] [Interview bio-ferm]

from Linz AG) and were stated to be 3.56€ excl. VAT for the one-time disposal of a 120 litre container.

According to [ORF 04] AGES has not found residues in honey in 2008. From the viewpoint of the beekeepers this was "quite surprising" because "in Switzerland there were contaminations".[513]

C4.2.4.4. Market Response Risk (Image Loss) for Beekeepers

In [APA 09052008] the Styrian "Imkerbund"-Chairman Mr. Josef Ulz stated that "beekeepers in the region [remark by the author: where streptomycin is used] struggle with a possible image-damage"[514]. As beekeepers mostly market their honey directly, they may face severe problems as to market response. If it is assumed that Austrian honey is purchased because of expectations of high quality and the natural state of the product (which may not be expected of e.g. honey from China), especially regular customers might be scared off. Asked for these costs, Mr. Ulz stated in the [Interview ÖIB] that the costs to preserve their image and the losses of sales to the beekeepers are "hard to estimate". Using streptomycin in the long run and having public discussions on the possible contamination of honey each year will not be very damaging to the bee-keepers.

C4.2.4.5. Further Costs for Beekeepers

Further costs for the beekeepers due to the use of streptomycin are additional working hours spent with

- coordinating work regarding the monitoring (e.g. the information of all beekeepers within the organisations, but also those not belonging to organisations[515]);
- communication work to prevent an image loss amongst consumers (PR work done by beekeepers),
- moving of bee-hives (out of areas, where spraying is planned)
- taking samples of honey (honey has to be mixed and samples have to be packed and sent in for testing).
- Streptomycin is not on the lists of the BAES naming agents that are (slightly) hazardous to bees[516], but long-term consequences and effects of which have to be expected on bees (and other insects,

[513] [Interview ÖIB]
[514] Translated by the author
[515] E.g. [OÖLR 01]
[516] [BAES 01] "hazardous to bees" and [BAES 02] "MINDER hazardous to bees"

worms, etc.) which are not known yet and consequently could be another risk.

C4.2.4.6. Costs of Residue Testing of Streptomycin in Fruit

Because of the food retailers' and the "AMA" quality seal concerns (most presumably provoked by the massive consumer reaction, because there were no reactions from these stakeholders in previous years of streptomycin usage) samples had to be tested for residues. The cost for testing fruit (apples and pears) from sprayed areas can only be guessed and be even higher than the testing of honey (stated to be 75.00 € excl. VAT[517]) due to new methods now used, that have resulted in the following, absolutely new findings, as stated in the next paragraph.

C4.2.4.7. Health Risks Deriving from Residues in Fruit

Just before closing the study, news has been reported on the sudden findings of streptomycin in apples (against all previous assumptions). Of course this has to be judged as a further source of risk for breeding antibiotic resistance and has immediately been objurgated by a physician interviewed in an ORF news show.[518]

C4.2.5. Further Indirect Costs and Risks for Farmers

C4.2.5.1. Market Response Risk (Image loss)

As the media has taken up the issue of agricultural use of streptomycin this year (2008) there has been a huge public response. Food retailers, in their desire to satisfy their customers, have reacted quite differently from each other (see Annex II for responses of food retailers to emails sent by the author). Hofer KG has not seen any reason for not selling apples from treated areas, if it was proven that they would not contain streptomycin, but others have been considering to exempt apples from streptomycin-treated acreages from stores of some supermarket-chains (see e.g. [ORF 01]). 2008 the problem could be avoided because only (approx.) 150 ha were treated with streptomycin and apples from these acreages are not being sold in Austria, but are destined for export. Regarding future sprayings, the conflict will no longer be avoidable, since the apples have just recently been proven to contain streptomycin.

[517] [AGES 08], p. 2
[518] Watched by the author on ORF on the 14.11.2008 at 17:00pm

With 55% of all pome-fruit-farms stating to sell at least part of their products mainly by direct marketing,[519] it should be considered that consumers might react very sensitively to the agricultural use of streptomycin.

C4.2.5.2. Lost Subsidies and Risk of Loosing Quality Labels

The **ÖPUL** subsidy amounting up to 300€/ha is granted to farmers for the total acreage of their farm, if they restrict their production measures to the use of plant protection agents issued on the IP-List. If an agent is used, that is not on the list, the subsidy is lost for the whole farm. This is the normal procedure. But farmers using streptomycin (clearly not being on the list) only loose the subsidy for the sprayed acreages in 2008.

Moreover there have been discussions on whether apples from the streptomycin-treated acreages would be allowed to carry the **quality seal of the AMA** GesmbH. The loss of the quality seal bears the risk of reduced sales-prices and diminishing the achievable profit.

C4.2.6. Further Indirect Costs and Risks for the Austrian Society

The author has found it very difficult to allocate the **state overhead costs** of the usage of streptomycin against FB, because data was not found to be available in an adequate time frame (see e.g. [Interview AGES 01]. Apart from the costs already mentioned, the process to authorize streptomycin in Austria involved the communication of many parties and it has been found difficult to determine the costs of time efforts in exact quantities. Therefore these shall only be mentioned, but not calculated:

- The negotiation process in the round tables involved many stakeholders, necessary to reach an agreement.
- The appeal for exemption to the Directive at EU-level (and notifying all other MS) was necessary.
- The legal notice had to be issued and security preconditions elaborated.
- The beekeepers had to be informed about the possible contamination of honey.
- The monitoring of honey had to be planned (screening of samples

[519] [Statistik Austria 2007 census], p. 18

taken has been mentioned already).

- Communication with the alarmed public (for example by an ad in a cooking magazine[520]) reassuring the consumer that Austrian apples which can be bought, are not contaminated in any way (which is furthermore not true –as revealed now) – it is not an easy issue and also the media has been observed to state that "apples are vaccinated with streptomycin"[521]) Risk of a possible loss of image and (loss of faith in) the Austrian Government.

C4.3. Benefits of Streptomycin

C4.3.1. Efficiency of Streptomycin

The grade of efficiency of streptomycin regarding FB ranges between 70% and 90%.[522] In the Austrian Plant Protection Product Register ([BAES 04]) it is stated that "for reasons regarding the active substance a sufficient efficiency is not given in all cases. Possible damages due to lacking efficacy or damages on cultured plants are in the area of responsibility of the user" and that a "repeated usage can lead to reduced efficacy"[523].

Table 13: Efficiency of Streptomycin

Trade name (Company)	% of strepto-mycin sulphate	Strepto-mycin/kg	Application rate[524]	Efficiency
"Strepto"[525] (Globachem nv, Belgium[526], producer)	21,6%[527]	180g/kg	0,0375% (600g/ha)	70-90%
"Strepto" (Schneiter Agro AG, assumed to be the retailer in Switzerland)[528]	21,6%[529]	180g/kg	0,0375% (600g/ha	70-90%

Furthermore, no matter what the weather conditions would suggest there are only three applications allowed as a maximum and only if the forecasting systems

[520] [AGES K&K]
[521] Cited and criticized by [Liedlbauer 2008] (translated by the author).
[522] Critics claim that there are also studies (conducted by the AGES) showing an efficiency grade of 23% only, but this information is not verifiable by the author.
[523] [Cornell University 2003], p. 10
[524] At a standard tree volume of 10.000m3/ha
[525] [lawa 2008], p. 15-21
[526] [BAES 04]
[527] [BAES 04]
[528] According to [lawa 2008], p. 21: "sale in Germany since 2004, in Austria since 2006"; further information see [lawa 2008], p. 15-21
[529] [lawa 2008], p. 15-21; [BAES 04]

issue warnings. One must bear in mind that during a warm and humid spring (like e.g. 2007) weather conditions favourable to the growth of the bacteria would apply to much more than three days, and hence must be seen as a problem in the connection with streptomycin use.

Streptomycin cannot be mixed[530] with any other plant protection product (not enabling cost savings).

C5. Assessment of Blossom Protect

C5.1. Direct Costs of Blossom Protect

The producing company "bio-ferm GesmbH" recommends four applications of the product at 10%, 40%, 70% and 90% open blossom.[531] These intervallic oversprays during blossom time seek to optimally protect the maximum number of flowers, which do not all open at once but in delayed phases, and to exploit the maximum efficiency (independently from the weather and forecasting systems). The farmer can spray whenever he (based on his knowledge of the respective orchard and the expertise regarding weather) judges it to be important, which is a great advantage, but also requires the farmer to take responsibility.

Table 14: Quantities and cost chart; Sources: [lawa 2008], p.8 and [Steinbauer Spraying Costs]

	Component A	Component B	Total	Costs/kg	Costs/ha
Tree volume 10.000m^3	10.5kg	1.5kg	12kg/ha	7.92€	95.04€
Proportion A/B	87.5%	12.5%	100%		

According to the information from bio-ferm the end user price is 95€ per treatment, resulting in annual protection costs for one hectare of 380€ excl. VAT. This information equals the assumptions of the calculation provided for in [Steinbauer Spraying Costs].

Also with BP (likewise to streptomycin) the costs of spraying include the use of equipment and working time. The calculation retrieved from the Styrian Government by Dr. Steinbauer [Steinbauer Spraying Costs] has assessed these costs to be following (following the procedure already outlined with streptomycin):

[530] [lawa 2008], p. 15
[531] [bio ferm 04]

Table 15: Cost of Spraying Blossom Protect; Source: [Steinbauer Spraying Costs]

Total Application Cost/ha (for 1 application):	50.61€
Total Application Cost/ha (for 4 applications):	202.44€

Again, these costs are accumulative to the costs for the spraying agent itself, aggregating to annual costs of **582.44€/ha/year** (202.44 + 380.00) for protecting one hectare of the orchard.

Further direct costs involved with BP

Although current understanding based on contemporary results is that there are no human health risks involved with handling the product it is obligatory to wear a special mask and gloves etc. As learnt from the [Interview bio-ferm] these measures are obligatory as soon as plant protection agents are concerned regardless of the actual expected harm. Likewise rests have to be disposed as special waste: "Nobody would dispose baker's yeast as special waste, but as soon as it is sold as a plant protection agent" Dr. Donat stated in the [Interview bio-ferm]. Further the label[532] has to carry "R42/43" which is obligatory because it is a microorganism (according to EU regulation).

There are no costs for additional technical prerequisites: the normal spraying device can be used without additional appliances afforded.

Treatment of susceptible apple cultivars (e.g. Fuji, Golden Delicious, Pinova, Elstar[533]) can lead to increased **fruit-russetting** but is not scientifically proven: "In some years, on some susceptible cultivars it can lead to fruit russeting[534]. But there is no real quintessence gained form statistics. Also other plant protection agents and even water can cause fruit russeting." The only optical deficiency of the apple peal (not being shiny and smooth), but a bit rough, has to be seen as a possible reduction factor to prices realized on the market. The author must state at this point that in organic fruit growing these optical deficiencies are much more accepted due to the customers' orientation; not on the appearance, but on the contents and taste of the fruits.

[532] See [bio-ferm 10]
[533] [lawa 2008], p. 8
[534] Fruit russeting is solemnly an optical blemish, but can lead to lower price yields on the market.

C5.2. Risks and Indirect Costs of Blossom Protect

For BP all this information is available and the requirements are met for the inclusion to the Annex I of the Council Directive 91/414/EEC – now only being a matter of (bureaucratic waiting) time. In the Annex III of the Case Study the author has consolidated all the data requirements in order to comply with the Directive that are completed by BP: risks involved with the usage of this product are profoundly tested and results are available.

Table 16: Cost-Benefit-Analysis Input Factors (left hand side questioned by the author, right hand side answers given by Mrs. Dr. Donat); Source: [Interview bio-ferm]

Risks involved with application of the plant protection agent	"None, because there are finished studies proofing this"
Costs of additional technical prerequisites	"Normal spraying device, no additional appliances afforded"
Toxicity studies	"Done according OECD, EPA, EPPO"
Risk factor resistances	"None"
Risk of residuals in honey	"No risks: The use of this product does not result in problems with contaminations of honey and also not for bees. BP can even be dispersed by honeybees, using them as natural vectors for the application."
Testing of honey	"Not required"
Disposal of honey	"None"
Compensation for beekeeper	"None"

It can further be assumed that there are no risk factors deriving from bad handling and/or illegal application given, if a normal use of the product is understood. Because it is impossible to predict every possible eventuality of the term "bad handling", it has been agreed, for legal reasons, that there can't be a guarantee of no risk, e.g. eating a can of BP might, in fact, have an effect on the digestion…[535]

C5.3. Benefits of Blossom Protect

Since 1997 outdoor experiments have been undertaken, since 2002 trials (in controlled laboratory conditions and in outdoor trials) were done to quantify the efficiency of BP.[536] Trials follow the strict standards defined by the EU: EPPO PP1/166 (3), which regulates studies to implement standards for comparing the

[535] Please refer to the Safety Data Sheets [bio-ferm 05] and [bio-ferm 06] and read further application instructions, e.g. [bio-ferm 04] bio-ferm GesmbH: "Blossom Protect; Instructions" and [bio-ferm 07]

[536] [bio-ferm 03]

performance of new agents to other well known products. In the trials therefore streptomycin and other microorganisms were used.[537]

Regarding the efficacy of BP the author has found many different inputs:

- 78,4 in [bio ferm 08]
- 71% in [bio-ferm 02]
- 83,5 % (± 4,2 %) in [Pirklhuber 04_2008])

During the [Interview bio-ferm] it was learnt, that the "different values for efficacy data being in circulation are a consequence of which trials are accepted to be valid."

The validation question is about a certain level of FB infection pressure that has to be observed in the untreated control: trials are generally set up by treating different compartments of the trial zone with the different agents, but leaving one compartment untreated. The EPPO criteria prescribes, that the "untreated control" has to show a minimum of 5% of FB infection, so that the data gained on efficacy can be validated.

The author has received the most current status summary of studies on the efficiency grade available per email [bio-ferm 09] showing the efficacy grades that have been proven in accredited trials (according to international standards) from 2003 to 2008. From this document it can be gathered that the average grade of all studies for BP show an efficiency grade of 76.6%, whereas streptomycin reaches 81.9%.

[537] [bio-ferm 02]

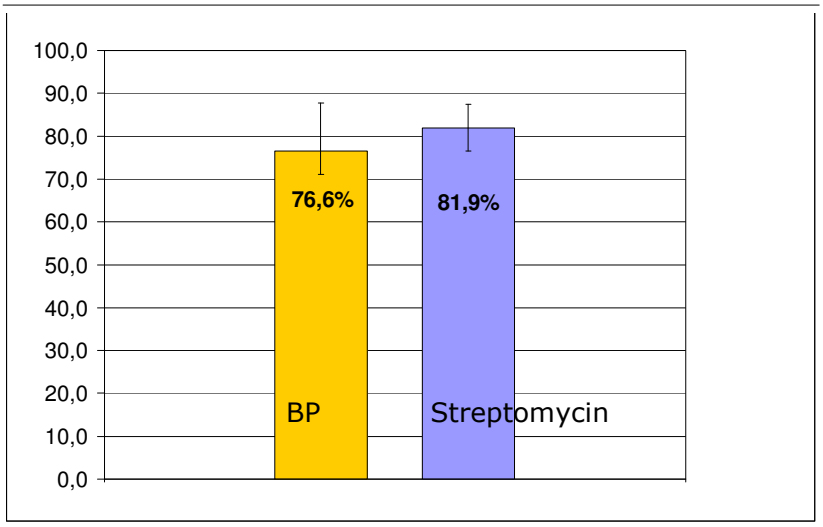

Figure 7: Comparison of the efficiency factors of Blossom Protect to "Plantomycin" (a plant protection product containing streptomycin); Source: [bio-ferm 09] "Efficiency grades against Fire Blight Blossom Infection", edited by the author

Hence, streptomycin achieves only approx. 5.3% better results than BP demonstrating that the performance of BP is comparable to the efficiency of antibiotics.[538] Results further showed that forecasting systems can be used to use yeast more targeted and that a combination with yeast-incompatible fungicides can be combined without losing efficiency.[539]

These values must been seen in the light of Dr. Donat statements in the [Interview bio-ferm]: "Efficiency grades are such instable factors that they should be regarded to by 10%-steps. Stating decimal places is actually doubtable. Overall Blossom Protect is approximately 10% under the efficiency grade of antibiotics on average."

Further the product can be applied, in combination with other products[540], enabling the saving of the fixed costs of spraying-tours. It is also possible to reduce the risks of the fruit-russeting this way.

[538] [bio-ferm 02]
[539] DBMELV 2006], p. 16
[540] According to [bio-ferm 04] and [bio-ferm 02] mixtures are possible with Pyrimethanil (Scala), Fluquinconazol (Vision), Thiacloprid (Calypso), Imidacloprid (Confidor WG70), Pirimicarb (Pirimor Granulat), Profital, ProAsete, Calciumchlorid and Biopro®.

C6. Assessment of Stakeholders (incl. Bargaining Power)

C6.1. Austrian Pome Fruit Economic Sector

The economic power of farmers is not as (economically) important as other sectors and as it might have been 100 years ago. Today the whole share of the agricultural and forestry sector (including fishery) of the Austrian economy as a whole in 2007 is stated to be responsible for a share of 1,8% (4,35 billion €) of the Austrian total gross value added of 245,20 billion€.[541] In another source of the Austrian Statistics Office the composition of the production value of the agricultural economic sector in 2007 at basic prices (values at current prices) is stated to be 6.355,9 million €, with fruits covering a total of 399.5 million €.[542] There is no further detailed statement on the share of the GDP of pome fruit growers. 5.1% (as per agricultural total account) of the total Austrian workforce is (at least) partly generating their income in the agricultural sector.[543] While the number of agricultural firms is to be observed to have a stable tendency to decrease over the years (from 308.246 farms in 1980 to 189.591 farms in 2005) the average acreage worked on per farm is constantly increasing (from 24,8 ha in 1980 to 39,9 ha in 2005):[544] A trend also monitored in fruit growing (nearly two third of orchardists, growing fruit as the main source of income, belong to the group of medium sized farms with acreages of more than 5 ha).[545]

Although the agricultural economic sector is not that big, the economic power might have derive from the fact that farmers still actually own[546] and cultivate most of Austria's land, extracting a great share of food for Austria's population. The Austrian self-sufficiency balance of apples ranges between 94 and 98% over the last years (pear 84% respectively) and is published in many documents.[547]

Also a look back in history might explain why the agricultural sector has high bargaining power towards the ruling ministry, despite it's decreasing economic

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[541] [Statistik Austria 2007 agriculture], p. 50, table 15
[542] [Statistik Austria 2007 GR], p. 5, table 2
[543] [LKÖ 03], p. 272
[544] [LKÖ 03], p. 313
[545] [Statistik Austria 2007 census], p. 14
[546] Also being an explanation found in [Interview bio-ferm]
[547] [Statistik Austria 2007 agriculture], p. 57, table 28: "Austrian self-sufficiency balance of fruit 2005/06 and 2006/07"); [LKÖ 03], p. 228: "Crop self-supply balance 2006/2007"; [LKÖ 03], p. 229: "Crop self-sufficiency grade" from Statistik Austria, Agrarpreisstatistik; the document [BMLFUW 2007] regards to the topic many times

importance: being a remnant of earlier times when globalisation and mobility had not facilitated international trade yet. Farmers were the only deliverers of food in the country, and therefore had an important status (depending on the size of land, farmers were wealthy entrepreneurs with a lot of staff working for them).

C6.1.1. Intensive Pome Fruit Orchardists

To fulfil the criterion of being a "full-time pome fruit orchardist" (whether organic or not) the minimum acreage laid down by the Austrian Statistics Office is 15 Ar (1500m2). Pome fruit plantations are defined to be income sources if the trees are planted according to a certain scheme and feature care conditions allowing for the production and marketing of high quality eating fruit (dessert fruit). Only apples and pears are regarded to fall under the term "pome fruit" in this concern by definition of Austrian Statistics Office.[548]

According to the EU-Directive 2001/109/EC the production potential of Europe regarding certain cultivars (apples and pears amongst them) has to be monitored every five years in a census: the latest report issued by the Austrian Statistics Office was 2007, from which the information in the following paragraph is taken, because none of the relevant institutions (especially AGES, BOV) provided information.[549]

On 7700 ha (62% of the Austrian fruit growing acreage) pome fruit were cultivated in 2007. 7200 ha thereof are apple orchards that are cultivated by 2391 farms (231 farms growing organic apples, who therefore have to be discounted). Hence, approximately 2160 orchardists were able to apply for streptomycin. Since the organic fruit growers have cultivated their products on a total acreage of 435 ha these have to be deducted respectively, leaving 6765 ha for a possible treatment with streptomycin. 80% of the apple orchards are located in Styria. The total numbers of trees in 2007 was 22.2 million trees (the number of trees has grown by 13% since 2002) and the apple-tree density has grown by 236 trees (+9%) to 3100 trees per ha. This fact alarms the author and must be seen as critical, considering the problem of a higher infection risk due to splashing water and wind (inter alia): the denser the trees are, the easier it is for the bacteria to disperse!

[548] For example stated in [Statistik Austria 2007 census], p.12
[549] See [Interview AGES 01]; [Interview BOV]

Over 50% of apple-acreage has been planted before 1998 and the orchards average age has even increased by one year (from 9 to 10 years),[550] the Austrian Statistics Office reckoning that this implies a decrease in the clearance of older orchards[551], despite the "heavy FB"-denoted year 2007!

Pears were cultivated by 1191 farms on a total acreage of 506 ha (increasing by 8% compared to 2002), 122 ha thereof (cultivated by 161 farms) have been cultivated according to organic criteria. 60% of the pear trees have been planted before 1998, 15% between 2005 and 2007.[552]

Accordingly, the author has calculated that "all"[553] stated farms, less the farms stated to grow fruit according to organic criteria, leaving the total number of farms for a possible streptomycin usage to be:

- 2160 apple orchards (= 2391 total[554] - 231 organic[555])
- 1030 pear orchards (= 1191 total[556] - 161 organic[557])

It must be remarked, that these values are not accumulative, deriving from the fact that the total number of pome-fruit growers is smaller than the sum of above stated orchards, namely 2600.[558] A farmer cultivating both apples and pears is counted in both categories.

Respectively the total acreages that could be treated with streptomycin are calculated:

- 6999 ha apple acreage (= 7230 total - 231 organic)
- 384 ha pear acreage (= 506 total - 122 organic)

According to another source[559] intensive fruit-growing of apples has been undertaken on 6061 ha (winter apples: 5864 ha + summer apples: 197ha) and pears on 414 ha (winter pears: 200 ha + summer pears: 214) in 2007.

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[550] [Statistik Austria 2007 census], p. 14 and 45
[551] [Statistik Austria 2007 census], p. 13
[552] [Statistik Austria 2007 census], p. 15 and 48
[553] Although oddly the Statistics Austria Office has specified the sizes of the orchards in a way that all of them have to be assumed to be orchards serving as income source, because the data on the acreage is not available for values smaller than 0.26 ha (the smallest acreage group is bundled for all orchards smaller than 0.26ha): therefore farms smaller than 0.15 ha cannot be deducted. See: [Statistik Austria 2007 agriculture], p. 58
[554] [Statistik Austria 2007 census], p. 44
[555] [Statistik Austria 2007 census], p. 48
[556] [Statistik Austria 2007 census], p. 45
[557] [Statistik Austria 2007 census], p. 48
[558] [Statistik Austria 2007 census], p. 44
[559] [LKÖ 03], p. 224

The Fruit Growers' Economic Situation

The impact of FB striking a farm (economic loss per ha) has already been displayed earlier in this paper. Here only further assumptions on the current economic situation of fruit growers shall be discussed:

2007 was stated to be a strong FB year[560]: the Agricultural Chamber reported that in Styria 542 fruit orchards (serving as income source) with approximately 2.000 ha acreage were affected by FB and 41 farms and two nurseries had to clear 22.2 ha apple and quince orchards.[561] In Vorarlberg 3 ha had to be cleared and 20 ha had to be pruned (of a total of 30 ha in Vorarlberg).

However, the pome fruit yield (of full time orchards) has been as high as 231.600 tons (more than 20% higher than 2006 and nearly 18% above the long-term average), a good crop yield was attained, particularly with winter apples and summer pears.[562] For "eating apples" the average price of 2007 was € 49.64/100 kg (constituting a price rise of 60.2% compared to 2006.[563] In [Statistik Austria 2007 agriculture] it is stated that "an exceptionally good result[564] has been attained in fruit growing. The considerable increase of production value (+31.3% compared with 2006) can be attributed for a big part to the strong increase of producer prices particularly of apples and stone fruit. At the same time the production quantity was higher than in the year before."[565] Accordingly for apples in 2007 the crop yield has been 221458 tons, increasing by nearly 20% compared to 2006 (184667 tons; oddly the LKÖ states a 17%[566] compared to the previous year). For pears an increase of nearly 30% has occurred with a harvest of 10158 tons (compared to 7825 tons in 2006). [567] Styria, stated to provide about 85% of Austrian apples, has had a 16% higher[568] yield than in 2006 (184147[569] tons of apples harvested) and "market prospects for the selling period 2007/2008 are judged positively on total".[570] From the [Interview OÖLVB] it has been reasoned that "an explanation could be the rigorous pruning back [Remark by the author:

[560] [DBMELV 2007], p. 37 et seq., even stated to have been the most difficult FB year in Austria by the [LKÖ 03], p. 45
[561] [LKÖ 03], p. 45
[562] [Statistik Austria 2007 agriculture], p. 9 in combination with p. 18 et seqq.
[563] [Statistik Austria 2007 agriculture], p. 27
[564] Also in the [Interview OÖLVB] it was stated, that by a agricultural chamber staff member the harvest was stated to be the "best ever".
[565] [Statistik Austria 2007 agriculture], p. 29 (translated by the author)
[566] [LKÖ 03], p. 44
[567] [Statistik Austria 2007 fruit], p. 3
[568] Data could not be counterchecked by the author, because of a different system of data consolidation used in the fruit crop report of the previous year [Statistik Austria 2006 fruit]: 2006 data is not comparable to 2007 data (by the author).
[569] [Statistik Austria 2007 fruit], p. 3
[570] [LKÖ 03], p. 45 (translated by the author)

cutting back of tree parts], which can trigger the fruit production of a tree and hence the crop obtained."

Also in 2008 the harvest has been very good (but no final data has been available until the closing of this case study).

It must therefore be assumed, that the **sector does not suffer any severe damage as a whole** (this is of course only to be observed on the base of these averaged values, not expressing the individual damage a farm might have been suffering). In May this year the [BOV 5_2008] says "the prices for apples from European production rise and rise"[571] and a month later it is even stated that the "**mood** amongst the representatives and producers respectively of the west European apple arable lands **couldn't be better**. A continuous active demand from east Europe and the unexpectedly smaller supplies from overseas push up prices."[572]

C6.1.2. Lobby Groups

C6.1.2.1 The Austrian Agricultural Chamber

The Austrian Agricultural Chamber (Landwirtschaftskammer Österreich, LKÖ) provides legal, economic, technical and social advice to those involved in agriculture and forestry. For better understanding a short look back in history shall be summarized from the information made available via the institution's website:[573] It is stated that already during the second half of the 18th century the first signs of representation for agricultural and forestry interests emerged in Austria. By 1850 "Agricultural chambers" were created by law, after the system of peasant subordination and dependency dissolved. In 1922 the first chamber of agriculture according to regional law in Lower Austria (followed by other federal regions) was established. It was an "autonomous interest representation" and coordinating body for the entire agricultural and forestry sector, with direct democratic elections and the right to raise funds, with costs being covered from the contributions of its members, and having sub-divisions. After the Second World War and the post-war confusion, the Austrian Chamber of Agriculture became a legally recognized body in 1953. "The main tasks of the Austrian Chamber of Agriculture are to support its members, represent farming and rural

[571] [BOV 5_2008], p. 22 (translated by the author)
[572] [BOV 6_2008], p. 18 (translation and emphasis by the author)
[573] The subsequent paragraph is based on [Agrarnet] (translated and summarized by the author).

interests to the state and other professional associations, and participate in official responsibilities of the government." It submits "proposals and expert opinions to authorities, especially in draft legislation and regulations, and consultation with officials" and assumes "administrative tasks which the government delegates to the regions (e.g. the formal processing of supportive measures)". As laid down by federal law, the Austrian Chamber of Agriculture has the right to examine and assess all draft regulations.

Today nine regional chambers of agriculture represent the agricultural and forest interests in the country, being public bodies, being centrally organized by the Austrian Chamber of Agriculture, with its head office in Vienna. The main purpose of this association is to represent the joint interests of the agricultural and forestry population to government officials and to public authorities in economic, cultural and taxation issues as well as in matters of taxes and fees, improving the overall situation of the agriculture (and forestry) sectors.

The LKÖ'S self-perception, despite the trouble caused for beekeepers in the streptomycin-cause, is "performing a major contribution being a connective link towards production"[574] the fruit production and the beekeeping industry. The author wonders where this link is between the use of streptomycin and the contamination of honey ruining the business of beekeepers.

The author has found that there are alarming views being bluntly declared to the media as e.g. Mr. Christian Krumphuber has revealed following opinion in the biggest Upper Austrian Newspaper (OÖN) that "intensive agriculture would be best for climate protection"[575]. Dr. Burtscher stated on the "information policy the Chamber of Agriculture 2008" during the interview that "on the occasion of the first application of streptomycin to pear trees the heading of the article said "No danger for apple trees"[576] and meant, that it would normally be expected, that "the main news of an article to be contained in the header." This rather uncommon information policy has also been found in the AGES.[577]

[574] [LKÖ 03], p. 45 (translated by the author)

[575] [OÖN 01] (translated by the author); response from the LKÖ stated, that this is only the "personal opinion of Krumphuber" (see [OÖN 02], translated by the author), along with opposing arguments, e.g. in [OÖN 03], that for the reason of higher energy demand, fertilizer-use, soil-erosion etc. this is not true.

[576] "Keine Gefahr für Apfelbäume"

[577] See chapter C8.3.1.4.

C6.1.2.2 Austrian Fruit Growers

The "Austrian Fruit Growers" (Bundesobstbauverband, hereafter: BOV) are the representation committee within the Austrian Agricultural Chamber. In the [Interview BOV] it was learnt that agricultural economic chambers are the representation bodies by law, and then there are voluntary representatives, like the BOV. These are often identical in staff: as for example the counsellor of the agricultural economic chamber responsible for fruit growing is also the General Executive Director of the BOV. Just as the LKÖ itself, the BOV is also the centralizing organisation at federal level and has its regional subunits in the nine provinces of Austria.

DI Greimel stated that "[o]rchardists are members of the nine regional fruit growing associations in the Austrian provinces. On provincial level there are managing committees of 8-10 people and their executive directors take part at the board meetings on federal level (Austrian Fruit Growers Association). Decisions taken in the board meetings are preferably aimed at achieving coordinated results."

The BOV clearly takes the position (reported[578] and also stated by the organisation itself[579]) that streptomycin is the only adequate remedy to FB. This is also communicated to the farmers via the internet or the magazine "Besseres Obst" etc. In this magazine the BOV states that "against the massive plant disease [remark by the author: FB] the most efficacious direct pest control is to choose, that is streptomycin at present".[580] Mr. Moosbrugger even states that "there is no other efficacious measure against fire blight" in [ORF 01] (translation and emphasis by the author) - another prevailing dogma besides the one that streptomycin cannot be found in apples anymore. In the next edition of the BOV-magazine it is proclaimed that "the BOV is not against alternatives. On the contrary, we would be happy, if we would not need streptomycin. We are only of the opinion that a pest of this extent also needs a commensurate answer, which can only be provided by the agent [remark by the author: streptomycin] at the moment."[581] Further on in this issue the BOV even stated that "as also international experts[582] confirm, yeast compounds do not have sufficient effect at the present and moreover side-effects (fruit russeting), which **can also destroy**

[578] [Interview OÖLVB]; [Interview ÖIB]
[579] [Interview BOV]
[580] [BOV 5_2008], p. 3 (translated by the author)
[581] [BOV 6_2008], p. 2 et seq. (translated by the author)
[582] Remark by the author: But no further explanatory notes on these experts is given.

the harvest."[583] Messages like these are without any foundations, but of course scare off farmers thinking about alternatives like this. Further streptomycin is defended by the following sentence: "Also if "Global 2000" apparently refuses to believe it, there is an expert report of a top-class working group of physicians[584] in the AGES that has come to the conclusion that "due to the default of firmed alternatives for the combat of fire blight nothing seems to oppose the usage of streptomycin for the therapy of acute threateningly plant diseases as "danger-in-delay"-provision under strict official control with regard to the inferior importance of streptomycin in medicine"".[585]

Farmers not living on apples however seem to be much more critical and some have proclaimed that there would be health considerations especially if the agent is sprayed near living areas because there are not studies on possible risks available[586] – just as Prof. Pittner argues.

C6.1.3. Assessment of Austrian Pome Fruit Economic Sector

In the agricultural sector the IMHO is involved in a very dense cooperation with, and dependency on, associations: partly because they lack the resources to gather information themselves and maybe also influenced by the factor, that their products bare highly technical differences, making it easy to bundle interests. It may be supposed, that the individual farmers act corresponding to what is perceived as being given, without further involving into literature search and EU law. As there are many plant diseases requiring solutions and numerous laws (and paperwork) applying to the individual farmer, they cannot be expected to get to the bottom of everything by scrutiny. Furthermore there is a very high degree of governmental interference and ongoing changes in regulation making it very difficult to struggle through all the applicable law regarding the size of an average farm, meaning some institution is needed to filter the information avalanche for relevant inputs for the individual farmer.

C6.2. Beekeepers

Formerly all Austrian beekeepers were organized under the Austrian Beekeeper Confederation (Österreichischer Imkerbund, ÖIB, presided by Mr. Josef Ulz), with

[583] [BOV 6_2008], p. 3 (translated by the author)
[584] However, the cited original statement and the persons responsible referred to in this statement has not been made available to the author (neither by the AGES nor the BOV).
[585] [BOV 6_2008], p. 3 (translation and emphasis by the author)
[586] [ORF 01]

sub-divisions in all 9 provinces of Austria (for hobby beekeepers) and a tenth sub-division for the full-time beekeepers. Because of controversies this organisation has been remodelled. The ÖIB is now the organisation only for beekeepers not depending on the apiary income and the full-time beekeepers have built up their own union, now called the Austrian Full-time Beekeepers Confederation" (Österreichischer Erwerbsimkerbund, ÖEIB, presided by Mr. Josef Stich). Because for the administration of subsidy-programs it was then necessary to build an umbrella organisation, called Bee Austria (Biene Österreich, BÖ, managed by Mr. DI Christian Boigenzahn).

The following information in the subsequent paragraph is taken from the [Interview ÖIB] with Mr. Ulz stating that within the ÖIB there are 22500 members within the EIB 252 together managing an estimated quantity of 450.000 bee-hives in Austria.

The honey production each year is approximately 5 million kg, being a long-term average (with production values normally ranging between 3.5 – 7 million kg). With the kg honey being worth 7.50€/kg (on average) the pollination work of the bees can be estimated to be a (more or less) ten-fold of this value:

7,5€/kg x 5 million kg = 37.5 million € x 10 = **375 million €**

This only includes the pollination work on cultivated plants. Calculating the pollination work on wild plant has to be seen to deliver an additional value that is very hard to measure.

From the interview with Mr. Liedlbauer [Interview OÖLVB] it is learnt that around 7000 beekeepers are organized via the OÖLVB in Upper Austria.[587] "The value of the honey-production in Upper Austria amounts to €10-12m a year" and the yield of 2007 sums up to 2170 tons of honey for Upper Austria alone and likewise it is stated that the "pollinations work performed by the bees amounts up to the decuple and can be specified with €100m."[588]

For a wider view of the problem the phenomenon of the "Colony Collapse Disorder" (CCD) should be considered: a "significant disappearance of honey bee colonies" is threatening "the production of crops dependent on bees for pollination

[587] 2003: 7500 beekeepers [Frühwirth 2003], p. 96 ff, Article by DI Hermann Wahlmüller and Ing. Ernst Simader, from the Agrarian and Forestry Law Department of the Province Upper Austria; 2006: 6712 beekeepers [ÖIB Statistic]

[588] [OÖLVB 2007], p. 15 (translated by the author)

as well as honey production" experienced in America (but also e.g. Germany), which led to the calculation of the worth of pollination (undermining the calculation above) held "responsible for $15 billion in added crop value, particularly for specialty crops such as nuts, berries, fruits, and vegetables."[589]

For the beekeepers the market response is perceived to have reacted very sensibly and customers were rattled when the media reported the threat of a possible honey contamination. This is why the beekeepers have decided on the following strategy: every honey that is tested positively is disposed, not only the ones above the allowed 10µg/kg (at the moment the detection limit is 5µg/kg). The relevant governmental authorities and the fruit growers did not understand at first, why beekeepers restricted themselves voluntarily to this so-called "zero-tolerance" approach. According to [Interview ÖIB] Mr. Ulz states, that "experiences have shown that residues are practically never higher than 20µg/kg" (of course resulting in lesser costs for governmental compensations and no problems for the fruit growers), but the beekeepers needed to react according to the wants and expectations of their consumers. Mr. Ulz states that the customer does not care about residue being within levels: "residues" generally are rejected, whether g or µg, the customer is concerned about his health. If any health risk is perceived to exist the product is easily substituted (demand being elastic). Also food retailers do not accept honey products with antibiotic residues (testing for themselves). Only when the discussions on possible residuals in apples came up in the context of the withdrawal of the AMA-quality seal and the boycott menaces of the food retailers, the fruit growers have experienced that the customer is not able to judge on the dimension of the human health risks, but only wants to know: has the product been sprayed or not sprayed?

C6.2.1. Assessment of the Beekeepers

Despite the economic benefit drawn from the beekeepers (as stated above) it is claimed in [Interview OÖIV] by Mr. Liedlbauer, that beekeeping is "a **hobby-sector in Austria**" and that there is **not much economic power**. The beekeepers have no real lobby. But the authorization (and usage) of streptomycin "was politically decided and not preventable"[590] (by the beekeepers). The beekeepers have shown much understanding[591] for the problems of the fruit growers and the governmental decision: Mr. Ulz stated in the [Interview ÖIB]

[589] [USDA ARS 01]
[590] [Interview ÖIB]
[591] Also stated in [APA 09052008]

that "[T]he minister [Remark by the author: of the BMLFUW] of course had to weigh up the economic impacts of the big group of farmers (2400 full-time-orchardists) against the relatively small group of beekeepers (in Styria e.g. there are only 40 full-time-beekeepers). Anyways it should not be that the beekeepers don't care about the orchardists going bankrupt. But we also had to fight for the understanding that a solution cannot be achieved by setting the residue limit up to 30µg (as suggested) because (as explained before) then there would be practically no honey above the residue limit. In my opinion it was underestimated, that beekeepers would refuse such a solution (but the reasons why have been made clear)."

Of course the reactions of the beekeepers have to be seen in the context of being affected by two different aspects of the streptomycin problem: their products are at risk of being disposed of rather than sold (affecting the customer base) but at the same time the discussion on streptomycin-contaminated honey causing human health hazards worsened their situation even more (due to the problem of reporting the issue correctly to the recipients (general public), which might come to conclusions based on fragmented or wrong information, deriving from the implications of residue limits, detection limits, etc).

Mr. Ulz in the [Interview ÖIB] states that in the long run the beekeepers "will not have the staying power to stand the loss of customer trust and sales: if every year there is a discussion in media on the use of streptomycin and every year the customer is made insecure again - this is not sustainable. The beekeepers have their backs to the wall." But the decision was conceived politically and was not preventable (by the beekeepers).

Fruit growing and bees are known to be linked, making it more incomprehensible that fruit growers are risking causing major existence problems in this branch of the economy (in America great parts of their have been considerable crop shortfalls of the almond harvest have already been caused by the shortage of bees).

C6.3. Consumer Market (Public) Forces

C6.3.1. Consumers

According to [AMA 2008a] apples are the most favoured fruit in Austria, with an annual average of 28kg eaten per person and 70.600 tons being sold each year.

There was a huge medial echo on the agricultural use of streptomycin in Austria, but what do the customers' scruples regarding streptomycin imply?

The Willingness to Pay (WTP) can be empirically assessed by means of revealed (indirect measurement of consumer utility by observation of consumer behaviour) or stated preference methods (trying to receive a WTP by asking for the evaluation of an improvement of their own safety (but also possibly including a positive eternality also on others).[592]

The WTP could be measured in the case of FB by asking people how much more they would pay, if apples were untreated. Because there has been no WTP measured up to now; it can only be inferred from consumers' indirect market behaviour.[593] The revealed preferences of consumers are observed by their decisions related to risk: [de Blaeij et al 2000] brings up the examples of buying a car with or without an airbag or whether a seatbelts are used or not and argues that "if sufficient information is available regarding the choice alternatives actually considered by the consumers, the implicit tradeoffs determining their behaviour, will be revealed."[594]

It must be strongly assumed, that a great proportion of the consumers of apples would not be able to assess the topic in the way outlined in this paper. "Sufficient information" is hard to obtain and necessitates engaging in the search of scientific journals, since the homepage of the AGES (the competent authority in regard to both the plant health risk of FB, as also the health risk issues of antibiotic resistance) has rather preferred to appease and placate their homepage visitors. No critical view on the antibiotic resistance risk is displayed; streptomycin is delineated, rather, to be "harmless"[595].

There is no exact WTP measured, because people have not been asked how much more they would pay for untreated apples and therefore it is not empirically assessed by means of stated preference methods. But as described above the WTP could also be inferred from the consumers' indirect market behaviour. Again this is not feasible because there are not treated apples being sold in Austria this year, but it is strongly suggested to assume that the customer wants untreated apples from the following study:

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[592] See e.g. [de Blaeij et al 2000]
[593] See e.g. [Brent 1991], p. 61
[594] [de Blaeij et al 2000], p. 8
[595] See e.g. [Telephone Call Hofer]

In August 2008 a **market-survey** has been conducted by [Integral 2008], trying to measure the market response on the spraying of streptomycin. Asked for the willingness to purchase apples from treated orchards, only 26% were willing to buy such apples, 71% would surely or rather not buy treated apples. 60% responded to the question whether they expected only non-treated apples to carry the AMA quality seal: "Yes, sure". Furthermore it was found out that 45% were strictly (and another 22% tending to) favouring supermarkets, which would not sell treated apples.

C6.3.2. Food retailers

The retailing sector was not included in the decision on the agricultural use of streptomycin from the beginning. Only when the media took up the topic and public response grew huge did retailers clearly became aware of the issue, some of them even reacting with the threat to boycott apples stemming from sprayed areas, not wanting to sell these products in their stores.[596] In the [BOV 5_2008] it has been stated, that Spar, Billa, Merkur and Penny have announced to only purchase goods from untreated cultivations.

The author has therefore tried to gather information on the viewpoints of the main Austrian food retailers by conducting an online survey[597] on how these companies are striving to take up on their consumer's wants and needs address the issue regarding the agricultural use of streptomycin.

The author wrote to following food retailers: Spar, the REWE group (Merkur, Billa, Penny), Unimarkt, Lidl, Hofer, Adeg, Plus (Zielpunkt). Respondents to the survey were Hofer KG, Spar and the REWE group (their inputs are attached in full length in the Annex to this case study). Zielpunkt responded that it could not take part at for corporate guidelines reasons. The other companies have not responded at all.

Summarizing, it can be said, that this year the actually sprayed acreage was so little that the apples from these areas were not marketed in Austria, but exported and the retailers had no problems obtaining untreated pome fruit in the needed quantities in Austria. In the [Telephone Call Hofer] it is assumed that this decision was also taken "because of the considerations and the reservations (of possible

[596] [ORF]
[597] See [Survey on Food Retailers] in Annex II

negative impacts on animal, human and health) other food retailers have declared".

SPAR made clear, that in their opinion antibiotics have no place in food production, even if not detectable on fruit itself, Spar points out to the ecological consequences (resistances and soil problems being named explicitly) and argues that they know that their **customer do not want medicine-treated apples on the shelves.**[598] Furthermore it is argued, that the agricultural usage of streptomycin is a far-reaching issue, resulting in agriculture reflecting, because sometimes the easy way out is taken and it is not acted on behalf of the customer. Spar is the main purchaser of Vorarlberger apples and the only food retailer chain selling these.[599]

The **REWE group** only response to the results of the residue monitoring ordered by the AMA was that there are no residues to be proven on fruit, just as with 180 honey samples that were tested, and that the AGES is elaborating a holistic strategy for 2008-2013 to maintain nature-related pome-fruit growing in Austria in future.

Hofer KG responded with a phone call stating that it would have been "willing to sell apples from streptomycin-treated areas in Austria, demanding that residues of streptomycin would not be found on the apples or would be below measurability of scientific proof of the residuals".

C6.3.3. Media

The involvement of media is not to be forgotten and must be attributed to be a major force in information transport and public force activation. Because of media interest that led to picking up the issue, the resulting public outcry and serious concern became possible and suddenly the issue preoccupied a great share of the public, internet blogs filled (see e.g. [ORF 01]) and public nuisance was proclaimed. The difference must be seen particularly in connection to the years 2005 and 2006, when streptomycin was used in Vorarlberg only and the media could not be motivated (although Global 2000 had tried to do so). It must be assumed, that considerate media attention and the corresponding food-retailer reaction has caused the withdrawal of the AMA-quality seal, because it could not be risked to loose the image of the quality seal in public opinion.

[598] See Annex II 9. 1) [SPAR] –original response
[599] [ORF 03]

C6.3.4. Assessment of the Public Force

Although streptomycin has already been used in the two years before 2008 (as displayed before) the public discussion experienced in this year has provoked a completely different attitude towards the issue by the stakeholders. Farmers naturally producing to sell their fruit on the market have experienced rising consumer resistance to the production process involving antibiotics, and the resultant reluctance of customers, whether these are based on understanding the issues completely or not, to purchase these goods.

Considering customers who are concerned to such an extent that they only want to buy unsprayed apples, the food retailers clearly have to provide these goods for purchase. This implies that unsprayed fruit has to be distinguishable from sprayed as markets ought to reflect the wants and needs of buyers with the appropriate goods from the producers. As a result food retailers could cream off a consumer surplus.

But market failures can occur due to asymmetric information problem and the requirement of sufficient availability of information on the alternative choices (considered by the consumers). It is stated by [de Blaeij et al 2000] that this requirement is very unlikely to be fulfilled. In the case discussed individuals consuming pome-fruit will presumable not overcome the following **obstacles**:

- Time constraints of searching for information on the mode of action of agricultural antibiotics and the effects on human health.
- Uncritical acceptance of the information failure provided by the relevant governmental authorities (conveying the impression, that there are no risks involved with spraying streptomycin). Efforts to involve with the topic might even be left undone because of complete trust in governmental action.
- The topic is highly technical and sophisticated. It cannot be assumed that everyone is capable of understanding what consequences (externalities) will have to be faced by the agricultural use of streptomycin and how these could affect him. A
- A possible bias reported in literature is the "perceptual disorder" (in fact a human error) occurring regarding the perceived value of risks of statistical lives compared to identified lives[600] and the attitude that it

[600] [Moore 1996]

will not strike exactly me, but others and (being a problem of subjectivity). Sizeable literature documents that overstating low probability events and underestimating the risk of high probability events bias individual risk assessments.[601] [Viscusi 1993] highlights this to be the finding that workers will not demand compensation proportional to the rise of actual risk involved with their job because they underestimate the risk.[602]

However, it may be interposed that customer reaction must also be seen from the viewpoint that ecological awareness is rising and individuals wish to curb environmentally damaging behaviour. The purchase of an eco-efficient car might not be feasible, but preventing the antibiotic use in agriculture with the purchase of untreated apples, may seem a small, but constant contribution to the customer.

C6.4. AMA

The Agrarmarkt Austria Marketing GesmbH (AMA) is the institution granting the AMA quality label: "The AMA quality seal guarantees by independent control quality food that fulfils criteria above the legal requirements and of which the origin is traceable"[603]. The label has a key function being the "only quality and origin seal, that is known by consumers and confided in".[604]

It is stated by [AMA 2008a] that "the consumer can put trust in a responsible-minded and resource-considerate production method of indigenous farmers with the purchase of a AMA quality seal product and be sure of the safeness of food stuff."[605] That the production method of apples from streptomycin-treated acreages does not fit in this description has been shown within the previous chapters of this case study and is important to keep in mind during the following chapter/paragraphs.

The basis for the AMA label being granted is the production of agricultural goods according to the "ÖPUL-special directive"[606] and the coherent IP-list[607] - restricting the production process to a (positive) list of agents (excluding agents

[601] Stated by [Viscusi 1993], p. 1918
[602] [Viscusi 1993], p. 1919
[603] [BMLFUW 2007], p. 27 (translated by the author)
[604] [LKÖ 03], p. 96 (translated by the author)
[605] Translation by the author
[606] In German: "ÖPUL-Sonderrichtlinie"
[607] In German: "Betriebsmittellisten für integrierte Produktion" = "IP-Mittelliste"

that would be allowed for by law).[608] Of course, streptomycin has not been on the IP-list, whereas Blossom Protect, for example, has been.[609]

In December 2007 the fruit of 180 Austrian orchardists (with a total acreage of 1600 ha) were authorized to carry the AMA-label. Just recently on 01.01.2008 the Obst Partner Steiermark GmbH (OPST) has joined with additional 759 producers (4.447 ha). Now three quarters of fruit of the sold in Austrian food retailers are labelled with the AMA-seal.[610]

In Spring 2008 the AMA announced in a press release, [AMA 2008] (translated by the author), that it has, together with the BOV, come to following agreement: under the header "withdrawal of usage rights for AMA quality seal at all fire blight treatments" it is stated that "the AMA label is withdrawn for pome fruit of those acreages which have been treated with the active substances **"streptomycin" or "yeast preparations"** during blooming time. The plant protection agents "Strepto", "Firewall 17 WP" and "Blossom Protect" have been authorized for limited time according to §13 [Austrian] Plant Protection Law 1997 (in the actual version in effect) specially for the control of fire blight"[611] The next paragraph says: "Additional residue monitoring and risk assessment" as a header and further claims: "The concerned pome fruit-cultivates of the quality-seal producers will be from now on examined an additional residue monitoring as well as a risk assessment regarding these agents. The representatives of food retailing are invited to cooperate. After risk assessment has taken place an evaluation of results will be done. If no residues of streptomycin or of yeast preparations (and their brake down products) are proved, this pome fruit will be entitled to carry the AMA quality seal after harvest in autumn" (of 2008). A procedure being completely unintelligibly and definitely lacking scientific reasons for the biologic agent BP!

According to Dr. Donat [Interview bio-ferm] the AMA gave two arguments:

- The products have only emergency use permission, which is correct, but altogether 11 plant protection products were on the market under this permission, AMA withdrew the quality label only for the products to be used against FB. Furthermore the author remembers that the product is listed on the IP and organic list and even legally authorized

[608] [AMA 2008a]
[609] [ÖPUL 03_2008]; [ÖPUL 05_2008]
[610] [AMA 2008a]
[611] [AMA 2008]

as a "plant strengthener" (not only by exemption rule) in Austria due to the legal peculiarity already described in a previous section of this paper.

- Possible residues on fruits AMA stated in spring 2008 that fruits will be investigated from AMA concerning residues of both products, and if no residues will be found the labels will be restored. On the [BOV HP] it is stated that „the results of the residue monitoring concerning pome fruit and honey are not available yet, but are expected for pome fruit in August". Interestingly on the 14th November the news brought the fact, that residues were found in apples! Whereas it is now clear, that the label for streptomycin treated acreage will not be restored (because of the found residues), Dr. Donat claims that "there were no investigations done for Blossom Protect, and the label was not returned till now (November 2008)". Whereas BP is completely harmless for humans, nevertheless the quality label was withdrawn from both products.

Recalling the fact that BP is a product having a legal authorization as a **"plant strengthener"** and is actually **allowed to be placed on the market freely in Austria** at the moment (as already outlined earlier in this paper), it has also been found to be stated on the **IP-lists in 2008** and on the list for **organic farming** (during the danger-in-delay authorization period) it is not understood by the author on which legal grounds the AMA has based these constraints!

C6.4.1. Assessment AMA

Of course the proceeding described above must be rated to have severe economic consequences for farmers using BP by potentially not obtaining the AMA quality seal:

Despite the "higher" direct costs, (although this has been proved wrong by the cost benefit analysis) and the ecologically sound behaviour, not causing any negative external effects, these farmers are "punished" (and not given the chance to obtain the AMA quality seal again, because the tests for residues are simply not undertaken) the regulating institution creates a completely adverse effect to the issue. Farmers using environmentally sound methods should be supported (maybe even by financial compensation – the author knows a case, where the community has actually granted the farmer the difference between the costs of a streptomycin product and BP). Despite the transported information, they are foresighted and concerned about the environment, willing to internalise

(perceived) indirect (external) costs. By their decisions (whether scientifically founded or not) the AMA can also greatly influence the economic well-being of the farmers.

Moreover, the importance as a stakeholder is also to be seen from the fact, that the AMA is the authority responsible for the control, handling of payments (and penalizing) of the ÖPUL-subsidy[612] but also in regard to all other agricultural subsidies, for example the EU-subsidies for beekeepers. Furthermore the AMA is also involved with PR for the industry.

C6.5. NGOs

Despite my many efforts it was not possible to obtain any information directly on their opinion on the agricultural use of streptomycin neither from the WHO (status 15.11.2008), nor from the WWF. But the organisation "Global 2000" has picked up the issue[613] given an interview and seems to have been contributing to the public discussion on the issue through its PR measures (press conferences, Internet articles, networking).

As described before, Global 2000 revealed the mistaken allowance of streptomycin in Austria (when it was actually already forbidden by the EU) due to an equalization rule with Holland and confronting the minister publicly, with the effect, that streptomycin was placed on a list of forbidden agents in 2004. Although streptomycin was authorized again in 2005 Global 2000 has played a crucial role in detecting these malfunctions of governmental regulation and furthermore has tried to tackle the information asymmetry providing information on the "other side of the coin" by organising press conferences, penning internet articles, etc.

C6.5.1. Assessment NGOs

Dr. Burtscher from Global 2000 claims that he (his organisation) has never been invited by any authority to submit the organisations view, aligning with the statements of [Interview AGES 01] regarding the not open but closed participation at the FB-Round Tables (exclusively for invited persons). There was no interest of authorities to involve other parties than the ones directly involved.

[612] As learnt from the [Interview AGES 01]; However, the responsibility has not been clear (details further down).

[613] See [Global2000 01]; [Global2000 02]; [Global2000 03]; [Global2000 04]; [Global2000 05]; [Global2000 06]; [Global2000 FOEa]; [Global2000 FOEb]

Hence NGO could not play a part in the policy decision process, although maybe indirectly advancing customer resistance due to educational work: only by public relations, informing the public (overcoming the information deficiencies explained before), can the consumer have had access to the ((opposing) expert information (Dr. Burtscher is a qualified biochemist) of non-governmental institutions. As pointed out in the theory part of this paper the information provisions of these institutions therefore can play a crucial role; being the possible bridge in an information gap situation and the national (federal level) free-rider problems in international concerns (antibiotic resistance is a international concern, please remind the call of the WHO displayed earlier in this paper).

C6.6. Austrian Governmental Institutions

C6.6.1. Federal Ministry of Agriculture, Forestry, Environment and Water management (BMLFUW)

The Federal Ministry of Agriculture, Forestry, Environment and Water management (hereafter: BMLFUW), Division III/9 – "General Plant Health Affairs", is the supreme Austrian national level authority with it's field of activity covering legisprudence, issuing instructions to BAES and the provinces, political policy (fundamental) decisions and reporting to EC. The BMLFUW "represents Austria at international level (e.g. EPPO, OECD, EU)" and "is also participating in all relevant European Union Committees"[614]. The role of the BMLFUW in the authorization process is not retrieved by any direct information on the institution but more has been learnt from the [Interview BOV] mentioned in the assessment at the end of this chapter.

C6.6.2. Federal Office for Food Safety (BAES)

The BAES is the first instance (also as per EC-law) for execution of material law such as the Austrian Plant Protection Law[615] and the Austrian Plant Protection Agent Law (PSMG) [616]. From a hierarchical perspective the BAES is a subordinated authority (bound to instructions to BMLFUW) and is integrated in the organisation structure of the AGES. Dr. Blümel states that the "[t]asks of the BAES cover issuing orders (as a federal office) to the AGES but also externally to customs authorities (e.g. regarding import controls), but the BAES itself does not perform

[614] [AGES 14], p. 1
[615] In German: "Pflanzenschutzgesetz 1995"; stated in §6 (1) No. 5 GESG
[616] In German: "Pflanzenschutzmittelgesetz 1997"; stated in §6 (1) No. 4 GESG

analyses or other functional tasks and the decision competences and responsibilities are separated"[617]. On the homepage [AGES BAES] it is stated that the tasks of the BAES are (inter alia) the control of putting into circulation, and the authorization of, plant protection agents being the relevant authority of first instance for the enforcement of the Austrian Plant Protection Agent Law 1997 (as per §6 (1) GESG No. 4).

The BAES has been the authority responsible for authorizing the two plant protection agents containing streptomycin according to the §13 PSMG 1997 (danger-in-delay) on the 10th of March 2008 (just as in the years 2005 and 2006 for Vorarlberg).[618]

According to the Federal Austrian Law for Health and Food Safety (Gesundheits- und Ernährungssicherheitsgesetz, hereafter "GESG") rules in its first article that "for the safeguarding and the quality of nutrition a high level of health protection and the protection of consumer interests shall be aimed at in consideration of the precautionary principle and with the state of the art of science"[619]. Interestingly the articles §§2-5 GESG (§2: definition of terms; §3: health protection in the nutrition scope; §3a: health protection in the medical scope; §4: the Precautionary Principle in the area of nutrition safety; §5: protection of consumer interests) **do not apply**[620] for the fulfilment of the §6 GESG (laying down the different laws for which the fulfilment is incumbent upon the BAES: e.g. (inter alia) the fulfilment of the Austrian Plant Protection Agent Law 1997). This is, indeed, a very awkward provision, but maybe explains why the precautionary principle is set aside to such an extent by the authorization of streptomycin, because, as outlined before, the allowance of plant protection products clearly involves weighing up environmental/health hazards against better protection of plants (crop). Maybe this provision has to be seen as an extension of the room to manoeuvre in these realms.

C6.6.3. Austrian Agency for Health and Food Safety (AGES)

"The Austrian Agency for Health and Food Safety (AGES) is responsible for several tasks in regard to nutrition for the Austrian government. The organisation researches, analyses and performs inspections according to the policy guidelines

[617] [Interview AGES 01]
[618] [LKÖ 03] p. 46
[619] Translation by the author
[620] Laid down in §19(3) GESG

of Austrian Food Laws"[621] and delivers i.e. the laboratory analysis for detecting FB infection on host plants (required by the EC monitoring rules).

It is the relevant body coordinating all activities[622] and persons/organisations involved concerning FB in Austria (partially in cooperation with the provinces and respective professional associations including the realization of outdoor-test and alternative combat methods also including the use of bees as vectors).[623]

The AGES is owned by the Austrian Republic, represented by the (Austrian) Federal Ministry for Health, Family and Youth ("BMGFJ", current minister: Mrs. Dr. Andrea Kdolsky) and the BMLFUW (current minister: Mr. DI Josef Pröll). [624] Further the (Austrian) Federal Ministry for finance (BMF) is concerned with import controls by customs in collaboration with BAES and the allocation of financial resources, hence also playing a role in the organisational structure.

C6.6.3.1. Institute for Plant Health of the AGES

Together with BAES it "provides scientific advice on all phytosanitary matters" [625] (e.g. FB) "to the plant health authorities of the Provinces and to the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management"[626].

Round Tables are organized by the AGES Institute for Plant Health regularly,[627] but can only be attended on invitation, usually attended by members of two bee-organisations, the organic fruit growers association, the BOV (Austrian Fruit Growers), Consultants, the nine Chambers of agriculture, the agricultural experimentation centre (FA 10B Referat APSD, Graz (Haidegg))[628], the BMLFUW, attorneys of the provincial governments and, in the case of research-round-tables, all research partners.

Further tasks of the Institute for Plant Health of the AGES relevant to FB are (inter alia) the

- Diagnosis, identification and monitoring of occurrence and

[621] [AGES 03]
[622] [AGES 01], p. 10 - "(z.B. Schutzgebietsregelung)"
[623] [AGES 02], p. 77
[624] [AGES 04]
[625] [AGES 14], p. 2
[626] [AGES 14], p. 2
[627] 16.10.2003, 27.11.2003, 27.01.2004, 15.04.2004, 07.10.2004, 23.11.2004, 18.01.2005, 24.11.2005, 5.12.2006, 5.12.2007, 30.06.2008
[628] [APSD 01]

dissemination as well as analyses on the biology and regulation of plant pests, particularly of quarantine pests
- Development of integrated and biological plant protection concepts, in particular within the scope of emergency plans for quarantine pests and diseases.
- Specific assessments on plant protection agents and methods, particularly in connection with the "ÖPUL" subsidy program[629] (evaluation for IP-OEPUL subsidy and trials of biological efficacy)

Further in [AGES K&K] (in accordance with the above mentioned first task) it is stated that "at the Institute of Plant Health the notices of the competent regional offices on the occurrence of FB converge". However, it was still not possible to retrieve any consolidated information on the development of FB damages in Austria. The author has ploughed through the information available via internet (Round Tables protocols on FB) many of them not including[630] detailed and ordered information (e.g. tables are not provided), which can be used as a base for calculations, being of a more general descriptive character.

The only two departments found by the catchword "plant protection agent test"[631] are within the Institute of Plant Health.

C6.6.3.2. Institute for the Evaluation & Authorization of Plant Protection Products of the AGES[632]

This institute is stated to be responsible for the

- Active substance testing within the scope of 91/414/EEC (in contrast to the "plant protection agent test" just stated above)
- for the enforcement of the Austrian Plant Protection Agent Law 1997 and Regulation as authority of first instance, including monitoring and control of putting on to the open market;
- Co-design of legalistic norms and IP-regulations,

Who exactly is responsible within the AGES for pesticide residues testing of foodstuff (e.g. testing on residues of streptomycin in sprayed apples) has not been retrieved by the author.

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[629] [AGES 02], p. 82
[630] No data on FB occurrence in [AGES RT 01]
[631] Original Term in German: "Pflanzenschutzmittelprüfung"
[632] [AGES 02], p. 77

C6.6.4. Official Austrian Plant Protection Service

The Official Austrian Plant Protection Service[633] is at federal level only (with regard to FB), concerned with import controls as formal official function. Organisationally separated from the Institute of Plant Health (AGES) it is subordinated to the BAES. It is not involved in laboratory diagnoses, but passes on the contracts to the technical part of the Institute, from which it also obtains expertise opinion and issues legal notifications.

Regional Administrative Authorities (of the nine Austrian provinces), each with its Head of Provincial Government, have their "Official Plant Protection Service of the Provinces" (also called "9 Regional Plant Protection Authorities"[634]). The Official Plant Protection Service of the (nine) Provinces "are responsible for implementing plant health legislation for which they are competent for on regional level", e.g. carrying out the (obligatory) monitory inspections regarding FB (coordinated by the Official Austrian Plant Protection Service (APSD), with the BMLFUW being the central superior authority).[635] Furthermore, every township has a FB delegate and every province district has a technical expert reporting to the APSD.

According to [Interview AGES 01] the **controls of the usage of streptomycin take place by the APSD** via random inspections following a raster (or in case of suspicion) and in operating controls. Information exchange is stated to take place "regularly" between the APSD, the agricultural chamber(s) and the AGES in coordination meetings.

C6.6.5. Assessment of the Governmental Authorities

At [Interview BOV] it was stated that "[u]ltimately the BMLFUW decides (on the allowance of streptomycin), but strongly attends the opinion of the AGES in technical terms. In my opinion if the AGES would be strictly against it, the Federal Ministry would not oppose the AGES being the technically competent authority." When the author interposed the question, "What about the BAES?", DI Greimel (from the BOV) responded that "[t]he BAES is the technical/functional competent authority issuing the §13-authorisation for streptomycin. The Federal Ministry [remark by the author: BMLFUW] is the political competent authority: because the usage of streptomycin is a thorny question having a political dimension, the

[633] In German: "Amtlicher Österreichischer Pflanzenschutzdienst", [AGES 05]
[634] [AGES 14], p. 2
[635] [AGES 14], p. 2

BMLFUW takes over this task. For the authorization the Federation[636] and AGES (respectively BAES) are responsible. The use of the plant protection products is matter of the provinces, but the use is only allowed after the AGES has given its permission." Furthermore, DI Greimel of the BOV provides the information that the Federal Ministry ultimately bears responsibility and decides on the authorization of streptomycin after hearing all concerned parties in the Round Tables (at the AGES).[637]

Therefore the BAES, AGES and BMLFUW are the competent bodies located in this case study to interfere with market failures caused through the externalities (by adjusting shadow prices) displayed above. The Austrian Chamber of Agriculture states that the coordination of measures for 2008 has taken place since June 2007 via the BMLFUW and the AGES (FB Round Tables) involving (inter alia) the preparations regarding a possible usage of streptomycin.[638]

The presented governmental bodies would be responsible for installing a socially optimal solution for the Austrian society as a whole, balancing the failure of the market to adjust a price to all the indirect costs caused by the agricultural usage of the antibiotic streptomycin.

C6.7. Producers of Streptomycin (Pharmaceutical Industry)

As the author tries to introduce all stakeholders involved in the issue of the case study in this paper, clearly the behaviour of producers of plant protection agents containing streptomycin (e.g. the Belgian company "Globachem") should be discussed and assessed. Unfortunately the author has not retrieved any information from Globachem: although Mr. Koen Quaghebeur Globachem has responded to the author by referring to Mr. Zorn from "Zorn Pflanzenschutz" being their Austrian distributor, the author's questions have been left unanswered.

From all other information retrieved by the author during the occupation with the case study there has not been any evidence for the pharmaceutical industry interfering in the decision processes or using their bargaining power. Of course it can only be estimated by the author what is observed, and not what is going on

[636] Remark by the author: original term used in German "Bund"
[637] Stated by Mr. Greimel in the [Interview BOV]
[638] [LKÖ 03] p. 45

behind the scenes, but the author believes that no pressure has been used by the manufacturers of streptomycin: streptomycin is not a "push" but a "pull"-product (in marketing terminology) – the pome-fruit growers have demanded it at their own accord.

C.7. Cost Benefit Analysis

Economic efficiency of a procedure (or project) is given when the benefits are greater than the costs, and only projects with a positive net benefit should be realized. Assessing all alternatives, the one with the highest positive difference should be picked,[639] according to the general aim of maximizing the difference between costs C and benefits B. As explained in the theoretical part of this paper, if external costs exist, that are failed to be internalised by governmental interference, the CBA, calculated by a private firm, will lead to results which are different from the social CBA. The scope of the social CBA is wider because it accounts for all costs (whether they are direct, indirect, tangible or intangible) and the time frame can encompass a more long-run efficiency aim.[640] Future benefits can be discounted to deliver the net present value (NPV) to be comparable to costs in the present. "Costs are usually measured in market prices".[641]

The CBA established in this paper will take a closer look at two of the different possibilities that exist, to limit the risk of infection of pome-trees in intensive orchards: on the one hand spraying of the antibiotic streptomycin and on the other hand the antagonist (Blossom Protect). The evaluation of the alternatives is based on the following assumptions: mechanical operations (removal or cut-back of infested plants) are obligatory to be taken as soon as FB is discovered because it is a quarantine organism in the EU. Therefore a scenario of "non-action" is not feasible. Further, the probability of the exposure to (latent) FB infections cannot be assessed (and are not known for each orchard), because of numerous influencing factors: climate conditions in general (especially of previous winters), humidity and temperature during the infection period, rainfall-quantity and incidence, hail, wind, impeded drainage, potential vectors, susceptibility of host plant species, infection pressure in the orchard and adjacent vegetation, composition of adjacent vegetation (host plants) etc. All these factors together up

[639] [Brent 1991], p. 6: "the greater the difference, the greater the contribution of the project"
[640] [Brent 1991], p. 4
[641] [Brent 1991], p. 13

to now cannot be standardized. Therefore there are no data on the average infestation rate of orchards with FB in Austria and according to Dr. Blümel it does not seem feasible to try to calculate average infection rates (at least not in the scope of this thesis). The basic scenario therefore is based on the assumptions that all measures like pruning (cutting back of infected tree-parts or, in the worst case, clearance of the tree) are done, since these measures are obligatory. Considering the value of the orchards being at risk to be totally cleared and replaced by new ones, the NPV of the possible total economic loss per hectare due to a 100% FB infection has been calculated earlier in this paper. E.g. 63190.92€ has been calculated to be the NPV of the total costs incurred if one hectare of an intensive apple orchards is lost due to FB. And likewise these costs have been determined to be 46919.09€ for intensive pear orchards per year. As shown above earlier there is a total of 6999 ha apple acreage and 384 ha pear acreage that could possibly be sprayed with streptomycin (in 2600 intensive orchards).

So what is the maximum benefit from spraying streptomycin and the biological plant protection agent BP (later on compared to the costs) if we consider an absolute worst case scenario, assuming that otherwise the total acreages would be infected, when not sprayed? "Saving" the total acreages of intensive pears and apples in Austria by spraying would generate a benefit of 6999 ha x 63190.92€ (NPV Apples) + 384 ha x 46919.09€ (NPV Pears) = 460290179.70 € **(460 million €).** These 460 million € could be saved, if there were a 100% remedy. As it has be shown, this is not the case, but available plant protection agents will only be useful up to their efficiency grade. The author has decided to assume the efficiency values according to the figures shown above. The efficiency grade of streptomycin is assumed to be 81.9%, and BP 76.6% respectively. Therefore the total benefits of spraying streptomycin will be saving costs of 376977657.20 € **(376 million €)**. By using BP the costs of 352582277.7 € **(352 million €)** are saved respectively.

But as explained earlier the **"efficacy"** of a control measure is seen to consist of the following factors: efficiency, costs/ha (direct and indirect), but also intangibles risk for public health and ecotoxity. These costs shall be summarized in the following CBA.

Actual imposed costs (only variable in their height) and risks taken (which may cause costs as well) are found to be distributed amongst different parts of the Austrian economy (the pome-fruit orchardists and the beekeepers) as well as to

Austrian society as a whole and are therefore allocated to these three different groups. Of course costs (and risks) imposed on society as a whole involve the pome-fruit orchardists and the beekeepers as well. Because the government does not carry the costs per se, but imposes costs on the general public (funded by taxes), the author has subordinated activities requiring governmental capacities (overhead costs) to be borne by society as a whole. As the author has not been able to feasibly adjust reliable values to these factors (because of missing data) the indirect costs are only listed. It has e.g. not been possible for the author to calculate how many samples would have to be tested in the case of a countrywide use of streptomycin (following the worst case scenario). The calculation cannot be done by simply assuming that all Austrian beekeepers are located in spraying areas, given the fact that orcharding is not undertaken in all parts of Austria (not congruent with bee-keeping) and would not affect ALL beekeepers. But it can be assumed, that nearly all Styrian beekeepers would be affected. Furthermore, estimates of the beekeepers' costs of moving bee-hives, of their sales reductions etc. have not been accessible to the author (because they do not exist), although it has been tried to at least describe the problem in detail in the respective chapter. Therefore the values of the **existing indirect costs and risks** are missing, but for reasons of visualization have been marked **red** and the **absence of risks and costs green**.

C.7.1. Putting it all together in the CBA

Table 17: COST BENEFIT ANALYSIS

	SZENARIO "STREPTOMYCIN"			SZENARIO "BLOSSOM PROTECT"		
	Full-time-Farmers	**Bee-keepers**	**whole Society**	**Full-time-Farmers**	**Bee-keepers**	**whole Society**
Direct Costs for plant protection per ha and year (maximum sprayings)						
Quantity (kg) of streptomycin/ha needed x cost of kg	234,00 €			380,00 €		
Equipment Costs (Tractor, 4WD, 50 KW + Spraying equipment, 30.000 m3, 550 lt) + working costs x sprayings	151,83 €			202.44€		
Costs of additional technical prerequisites	Special protection gear?			0,00 €		
Quantity of water needed x cost of water	omitted			omitted		
Safety measures to be taken	omitted			omitted		
(Aftercare) walks through orchard	omitted			omitted		
Non-use of other cultivars (e.g. grass below sprayed trees) (elimination required)	costs			0,00 €		
Elimination of these cultivars (Mowing costs)	117,27 €			0,00 €		
Lost ÖPUL subsidy per ha sprayed	300,00 €			0,00 €		
Subtotal direct costs / ha / year	**803,10 €**			**582,44 €**		
Sprayable apple acreages in Austria	6999 ha			The usage of BP is not limited to this area, but will be calculated for these acreages for comparison reasons.		
Sprayable pear acreages in Austria	+384 ha					
Possibly sprayed area	=7383 ha					
Total direct costs spraying 100% of Austria's intensive pome fruit acreage	**5.929.287 €**			**4.300.154 €**		

Benefits (cost savings) from the possibility of mixing other plant protection products in tank	not possible			cost savings possible (-% equipment+working costs)		
Calculated efficiency grade x NPV of all Austrian intensive pome fruit acreage protected	**376.977.657 €**			**352.582.277 €**		
Deducting direct costs only	-5.929.287,30 €			-4.300.154,52 €		
Benefits for farmers excl. indirect and external costs	**371.048.369 €**			**356.882.432 €**		
Difference Str-BP (absolute maximum possible excess direct costs to pome fruit farmers), not including indirect, external costs and risks!	14.165.937,68 €					
Indirect and external Costs						
Appealing for exemption law at EU-level (and notifying all other MS) (governmental administration work)			costs			**? (*)**
Issuing of the notice of exemption allowance and elaborating the security preconditions			costs			0,00 €
Negotiation process to reach an agreement (in the round table, with the AMA, the food retailers etc.)	costs	costs	costs	0,00 €	0,00 €	0,00 €
Cost of movement of bee-hives because of spraying		costs				
Costs of taking and testing honey samples (costs of preventing the sale of contaminated honey): Residue-test costs x number of samples tested			75,00€ /sample			0,00 €
Costs of compensating contaminated honey			5,00€/kg			0,00 €
Costs of disposing of contaminated honey			3,56€ (for 120l)			0,00 €
Profit losses of beekeepers (of the difference between sales price and compensation) 7,50€-5,00€		2,50€/kg			0,00 €	
Counteractions to save image (PR towards consumer)	costs	costs		0,00 €	0,00 €	

Time used for application, bureaucracy and controls (in honey monitoring processes; e.g. coordinating work regarding the information of all beekeepers		costs	costs		0,00 €	0,00 €
Costs of inspections on legal spraying (control quota, detection quota, sanctions etc.)						
Communication efforts with the alarmed public on possible health hazards (e.g. ad found in cooking magazine) by the government			costs			0,00 €
Costs of residue testing in fruit from treated acreages			>75,00€/ sample ?			0,00 € **(**)**
Costs for loosing "AMA"-quality seal (sale volume and price reductions) due to residues in pome fruit	costs			0,00 € **(**)**		
List of further risks associated with application						
Risk of fruit russeting (subordinated under "risks" because fruit russeting is not a sure cost, but is dependant on certain conditions without statistical significance)	0,00 €			risk		
Possible adverse human health effects due to higher exposure to the substance and residues for those handling the agent: side effects e.g. allergies, antibiotic resistance	risk					0,00 €
Resistance risk in farming: disturbance of soil equilibrium, including effects on species such as rainworms, etc.	risk					0,00 €
Risk of selecting antibiotic resistant E.a. strains and the resulting risk of higher FB infection rates	risk					0,00 €
Resistance risk in human medicine (likewise in animal husbandry), treatments of no/little avail, VSL losses due to fatalities and increased pain risks			risk			0,00 €
Risk of Allergies and other side-effects for general public (VSL losses due to pain etc.)			risk			0,00 €

Effects on certain aquatic organisms (environmental fate and behaviour in surface/ground water)			risk (toxic)			0,00 €
Short-term loss of sales (impact on sales of honey in sprayed season) and long-term sales losses (image loss of honey products) --> Risk of driving beekeepers out of business	risking 37.5 million € and 375 million € pollination work			0,00 €		
Risk of a possible loss of faith in the Austrian Government			risk			0,00 €
Risk factor of illegal sprayings			risk			0,00 €
Risk of boycott by food retailers of pome fruit from treated acreages	risk			0,00 €		
Short- and long-term image costs for orchardists	risk			0,00 €		

(*) because the product is permitted due to a peculiarity in Austrian law (as explained earlier).

(**) should be zero!

C.7.2. Assessing the results of the CBA

The benefits for farmers excl. indirect and external costs result in a "gap-value" of 14.165.937.68€ (entailing all the other costs and risks pointed out in the CBA), which can be seen to be the difference between the two alternatives in an absolute worst case scenario for the 2600 farmers allowed to spray, A "gap-value" of 5448.43€ exists per farm.

This is the absolute maximal economic advantage for 2600 firms, but will surely be much smaller due to listed indirect costs that may apply. Society as a whole faces only costs (particularly the beekeepers).

The governmental implicit evaluation of the WTP of the Austrian population (as per 1.1.2008 is 8.331.930 people[642]) is revealed to be lower than 1.70 € (14.165.937.68€/ 8.331.930) per year. This means that the governmental authorities assume that the average Austrian prefers to be exposed to the risks stated above rather than "paying" this amount. Considering that there is a considerable segment of customers purchasing organic food, and the market study revealing the preference of customers for untreated fruit, it is very likely that this WTP is underestimated.

Which value should be assigned to intangibles such as the reduction of quality of life because of prolonged suffering (due to resistant bacteria, as described before) or even loosing a life? The following chapter shall deal with this issue.

EXCURSUS: The Value of a Statistical Life (VSL)

Because many policy decisions affect at least the quality of human life (in regard to the health status of the individual), if not fatalities, these decisions are nolens volens related to attributing value to human life. Following the rule of economic efficiency the value of saving a statistical life must exceed the costs incurred to make the measure worthwhile. So what is the appropriate value of a life that should be worked into cost-benefit analyses? When does it pay off to prevent a fatality? Despite the question of whether it is ethical to adjust a value to (the quality of) life and however uncomfortable this question is - it is unavoidable in the realms of cost benefit analysis:

[642] [Statistik Austria population], p. 9

The degree of safety of (healthy) human life can be seen to be the degree of protection from risk, which is defined by the probability of health defector fatality in a certain time period.[643] However, preventing health risks (or attenuating a certain hazard) are normally achieved by the use of resources that are now unavailable to other utility increases: the more is spent on safety, the less can be spent on other needs of society. The same welfare problem of competing goals has already been outlined, discussing the allocation of the social optimum level of the environmental condition and the parallelism of the two areas is stated clearly by [Johansson 2006]: "The value of preventing a fatality or (saving) a statistical life is an important question in health economics as well as environmental economics."[644] In the case of environmental pollution the estimation of the benefits and costs of measures reducing risks are of interest.[645]

Restoring society's optimum safety level, the problem of competing goals occurs respectively: not ALL safety measures can be taken but rather the size of the achievable safety improvement has to be compared to the installation (reduction) costs, evaluating the safety measure at stake. Economic actions include certain risks, therefore [Viscusi 1993] argues that economic constraints hinder the reducing of risk to zero[646]. This can be seen in connection to the discussion in the theoretical part on the subject of the impossibility to restore a perfectly healthy environment, because utility is also driven out of goods even if their production entails certain environmental degradation. There is a certain social optimum level to be stabilized in the right trade off quantity between these competing goals. "Public health", just as the environment, is a public good. Hence, ignoring the adherent effects of activities there will be under-provision in case of positive externalities (human health safety benefits) and over-provision in case of negative externalities (adverse effects on human health safety). Governmental interference and its attitude towards human health risk create the balance between the "necessary evil" and its accruing benefits. If put on sustainable pathways "rising societal wealth will continue to generate greater levels of health and safety".[647]

Bearing in mind the fact, that (ceteris paribus) society prefers lower levels of exposure to risk of fatality or physical harm, it has to be appropriately traded off

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[643] Compare Jones-Lee, M.W.: in [Layard et al 1994], p. 290
[644] [Johansson 2006], p. Abstract
[645] [Johansson 2006], p. 2
[646] [Viscusi 1993], p. 1912
[647] [Viscusi 2007]

against other competing uses of resources, therefore being subject to economic valuation.[648] But as Jones-Lee puts it: "[p]erhaps the most difficult item of all to value is human life."[649] Using the definition provided by [Blomquist 2004] "The economics of the value of life is about what individuals and societies are willing to sacrifice to get longer expected lifetimes." [650]

Adjusting informal judgements of certain political decisions is at least better than simply neglecting and ignoring these issues (and realizing projects that allocate resource on a random base). Nevertheless, as outlined before, policy is subject to everyday decisions that which cannot be decided on such a basis, because it will not only lead to problems of inconsistency of decision-making on several alternatives but also between different decision makers. It seems, therefore, that there is no way of "getting around" the adjustment of a value to (healthy) human life in evaluating projects.[651] As [Blomquist 2004] puts it: "While ethical and estimation concerns remain, these values have proved useful in policy decisions about health, safety, and the environment."[652]

Empirical estimates of the value of life can be achieved by revealed preferences (retrieving implicit values from observations of individual's behaviour) or contingent valuation (by asking individual). Both techniques have their advantages and disadvantages and may well be seen as complementary[653] to each other as they tackle the problem from two sides. Not only consumers (as the paper has outlined before) make choices about their health and safety but also public sector agents reveal their preferences through their actual behaviour ("concerning tax and expenditure programs which affect expected lifetimes"[654]): simply put, a safety measure implemented at a certain cost, "C", that shall reduce a certain number of fatalities, "F", reveals the statistical life being valued C/F.[655] [Viscusi 1993] suggests that the "appropriate measure of value of life from the standpoint of government policy is society's willingness to pay for the risk reduction, which is the same benefit formulation in all policy evaluation contexts" (not only in the risk-money tradeoffs observed in labour market assessments that Viscusi originally researched on).

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[648] Compare Jones-Lee, M.W.: in [Layard et al 1994], p. 290
[649] [Layard et al 1994], p. 21
[650] [Blomquist 2004]
[651] [Layard et al 1994], p. 294: e.g. states that it is "literally unavoidable"
[652] [Blomquist 2004]
[653] See also [Layard et al 1994], p. 307
[654] [Blomquist 2004]
[655] Compare [de Blaeij et al 2000], p. 8

Literature clearly demonstrates that the implicit values regarding human life show high volatility (high variances). [Layard et al 1994] for example state the range from £1,000 to more than £20,000,000 per (statistical) life.[656]

Setting aside the reasons of these high variances (due to governmental failure), the author has tried to figure out an appropriate order of magnitude of the value of life used in public decision making. [Layard et al 1994] suggests that "if a "true" value of statistical life exists, it is very unlikely to be much less than £500,000 in 1987 prices and may, indeed, be well in excess of £1,000,000"[657]: 72.7%[658] of the most reliable estimates adjusted the value of life being "worth" more than £1,000,000. [Blomquist 2004] yields **VSL typically in a range from US$1 million to US$9 million.**[659] [Viscusi 1993] sets the cluster for reasonable estimates to be in the **3-7 million US$ range**[660] and finds that the trade-off estimates can vary considerably, and are not only dependent on the population exposed to the risk and their income level, but also on the nature of the risk itself (inter alia). [de Blaeij et al 2000] attribute these variations to the "persistent information problem facing governments" that can cause the revealed preferences by individuals to be "markedly" different from "the implicit individual marginal rates of substitution implied by governmental decisions on allocations".[661] Also [de Blaeij et al 2000] have shown the VSL to depend on the initial risk level regarding a (fatal) accident and on the risk decline that is being considered.[662] [Johansson 2006] finds that "income levels as well as risk attitudes also differ between countries". This, in his view, is an explanation for the phenomenon that "some studies arrive at very modest values while other studies report surprisingly high values"[663] which is found to be underpinned by the findings of [Gibson et al 2007][664]. Furthermore [Moore 1996] shows that "People value identified lives more than statistical lives because we are influenced by certain cognitive preferences inherent to human nature." [665]

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[656] [Layard et al 1994], p. 294
[657] [Layard et al 1994], p. 310
[658] [Layard et al 1994], p. 314
[659] [Blomquist 2004]: "based on estimates from risk-compensating wage differences, consumption activity which affects risk, and hypothetical markets"
[660] [Viscusi 1993], p. 1942
[661] [de Blaeij et al 2000], p. 8
[662] [de Blaeij et al 2000], p. 23
[663] [Johansson 2006], p. 23
[664] [Gibson et al 2007] e.g. presents estimates of the value of statistical life (lives saved from landmine clearance) in rural Thailand to be US$250,000.
[665] [Moore 1996] finding that "people find it psychologically painful to deny care to identified lives".

The values proposed in [Layard et al 1994] at least suggest a range of the value of a statistical life "for all commonplace "everyday" risks of quick and (one assumes) painless death". Others may have to be seen accordingly. But what about the value of **injuries or deterioration in health (non-fatal hazards)**? [Cohen et al 2003] examined the non-monetary damage compensations for **"pain and suffering"** (hence a measure for non-fatal injuries) yielding the implied value of a statistical life at approximately **US$1.4 to US$3.8 million**[666], being well within the range of the VSL stated above.

[Viscusi 1993] notes that previously only the lost present value of earnings was assessed, which led to dramatic underestimations of benefits evaluations and that the "policy makers' recognition of the nonpecuniary aspects of life is an important advance".[667] Differences arise for imposing protection policies on societal (social) groups who bear risks involuntarily (but thus have a high risk-aversion) in comparison to groups of individuals incurring risks knowingly (e.g. dangerous jobs), but it is also argued, that the temporal dimension[668] of risks is important, because health risks to future generations needs governmental interference much more.

[Viscusi 2007] reminds that not all market failures regarding risks are too great (and may be overcome by simple measures such as for example information asymmetry which can be rendered harmless by hazard warning policies) and that also in this case governments can exacerbate the problem (by causing inordinately high costs per live saved).

Which VSL to assume in the paper's CBA?

The author has cogitated over the question how to incorporate the provisions of the assumption on the VSL discussed within this paper in the CBA at stake.

It has been found extremely difficult to contrast the "maximum additional benefit value" of the usage of streptomycin (which is surely biased, because the deduction of external costs and risks due to missing values is not possible), with the VSL on the other hand, because risks are not known and there is no evidence. Despite the possibility of prolonged suffering and pain because of resistance to

[666] [Cohen et al 2003], finding that jury's awards were predictable (although subject to a high degree of variability)
[667] [Viscusi 1993], p. 1943
[668] [Viscusi 1993], p. 1943

antibiotics, and even fatalities due to missing medication, it is, however, very hard for the author to estimate how many people may be affected.

But, given the assumptions that there will be suffering and early deaths, the values have to be put in contrast somehow, so that calculations are not biased. The VSL has therefore tried to retrieve implicitly the Government's decision to impose higher risks on Austrian society as a whole, because the bearing of this higher risk is outweighed by the better economic situation of the 2600 fruit farmers by the value of life adjusted by Austrian Government permitting this procedure in the following example-scenarios: if only one person dies, the value of life will be smaller than 14.165.937.68€ (because further indirect costs have not been deducted from this value). If 10 people suffer their suffering will surely be "worth" less than 1.4 million €. But the author does not feel competent to judge these values and therefore calls upon the opinion of experts. Regarding the calculation of the risks to human health, but also the risks to farmers using streptomycin, this calculation must be seen in the light of the statements made by Prof. Pittner: "For the calculation of the adverse effects that the agricultural use of streptomycin brings about, it is probably only possible to calculate the minimum-damage (being the minimum, that has to be counted with), then explaining the nescience (lack of information) on many aspects. Only a semi-quantitative estimation of risks exposing ourselves to in the long run is possible. But it is important to note: dealing with the streptomycin problematic one has to bear in mind that there are many synergistic parameters intercalating, many of them still unknown. The impact on human health and the agricultural problematic are always to be seen connected. Risks taken do not have additive character, but multiply!"

It is therefore very likely that there would have been other possibilities to attain the real social optimum. The CBA makes clear, that efficacy at all cost does not reflect real economic efficiency, which needs to incorporate total costs caused against the benefits of the alternative measures.

C8. Conclusion of the Case Study's Findings

C8.1. Market Failures in the Case Study

Human health safety and a healthy environment possess the properties of joint-supply and non-excludability and are therefore both **public goods**, entailing all the problems of market failures attached to these.

Fruit growers, as participants of the market, are striving for their own profit maximization[669] (**individualism**) only bearing the direct costs (private costs) of their activities, whereas the full social costs are imposed on society as a whole. Of course, as described before, there is also the phenomenon of **non-individualistic behaviour** which can be observed when farmers who are authorized to do spray, but do not use the antibiotic and also from (reported) reactions of farmers not living on the growing of fruit.

The market activity producing fruit treated with antibiotic clearly creates side effects (**externalities**) affecting uninvolved individuals (society as a whole) as outlined in this paper. Not only will people - possibly - suffer from allergies (and other unforeseeable health hazards), but certainly this activity can lead to prolonged suffering (pain and stress) and even fatalities because of missing medical aid against infections due to certain bacteria resistant to antibiotics. Also, regarding the environmental risks taken, these are borne partly by the public as a whole (increased resistance pressure), and partly by the agricultural sector itself (loosing arable land because of resistances). The full costs due to the agricultural use of antibiotics are not taken into account by the economic sector of intensive fruit growing (not even concerning the risks inflicted to itself) caused by the intangibility of the impact and the difficult calculation due to uncertainties and gaps in knowledge. Although the products (fruit) increase utilities of consumers, they at the same time include these costs (health risks etc.). Hence a desire of the affected parties to modify the behaviour of the fruit growers should clearly be given, because loss of human welfare derives from health damage (diminishing quality of life), increased suffering, pain and fatalities, but also deserted acreages.

In the case analysed the **insufficient provision** of the goods *public health* and *environmental protection* emerges from the missing "market" of the benefits of streptomycin avoidance, or expressed in another way, because the prices of fruit of treated acreages (also relative to the ones of non-treated acreages) do not reflect the real costs of its production. The difference of these costs results in market distortions of the private market activity of "spraying" because it is subject to externalities.

[669] Even if the case has shown that there are fallacies attached to the comprehension of the direct costs and farmers have not even chosen the cheapest production technique.

The market equilibrium can only be reached if external costs and benefits are integrated. How is the integration to be achieved? As outlined before, following the **Coase theorem,** governmental intervention is not always needed to obtain a socially efficient outcome: if **property rights** are adjusted (in this case the farmers having the right to spray), affected individuals could start up negotiations with the farmers and tyro find an agreement for compensation payments for the non-use of the antibiotic. Considering that society as a whole (and even people beyond national boundaries) are affected in their welfare by this omission, it is a fact, that exponential transaction costs exist during this bargaining process, which does not make this allocation algorithm feasible.

Taxes (recommended by **Pigou, in order** to install an equilibrium) are a way to internalise the externalities caused in the case. As a matter of fact this mechanism is already used in the (reverse) form of subsidies for integrated production techniques (that will be granted the **ÖPUL-subsidy** and lost if using streptomycin). However, (as mentioned in the theory part) there are crucial problems of adjusting the right value. To outweigh the market failure completely the exact shadow prices of the externalities caused and their internalisation in the economic processes would lead to an increase of marginal costs (benefits) and therefore modify the supply curve (**production decision failures**). This implies that the shadow prices are known and can be determined on a calculable scale, which is shown to be extremely hard, if not impossible in this case study. The underlying interdependent risks and costs imposed on intangibles like the value (of the quality) of life make the estimation of "real social costs" of the usage of streptomycin more than vague. Costs and risks that are calculable at present are to be seen as the complete minimum (the tip of the iceberg). For completeness reasons of completeness, it has to be remarked that adjustments of taxes can also result in a segment of consumers being worse off: namely the ones who do not care about their health status[670].

Of course also **consumption decision failures** arise when individuals fail to consider the interdependence of their consumption pattern impacting the well-being of others: inhabitants of Vienna (where there is no direct spraying in living areas) do not necessarily consider the health hazards imposed on e.g. to people in Styria living close to the spraying areas, but only weigh up their private benefits against the purchase price (not considering external costs arising for

[670] E.g. assume certain individuals taking hard drugs (apart from alcohol & co) it is most likely, that these persons do not care about the health hazards deriving from the agricutural use of streptomycin.

others, apart from the risks incurring to their own health from the threats of rising antibiotic resistance).

To install sustainability also on the demand side, full social costs and benefits must be reflected and the **consumer surplus** has to be measured. Yet again it is shown, that private decision making differs markedly from public decision making and fails to measure the full social benefits – a market failure rising with the importance respective to the size of the project (as outlined earlier in the theory part).

If all the costs and risks would be reflected in the higher price of such fruit, the elasticity of demand would **shift demand** onto fruit from other production techniques (as e.g. fruit from organic production or from regions strictly not using the antibiotic like South Tyrol is available, substitution is possible). However, **asymmetric information** problems associated with market failure in this case study have derived from the fact, that the agricultural use of antibiotics against FB is a highly sophisticated, interdisciplinary and crosscutting issue additionally including many framing conditions and circumstances (a flood of existing regulations and regimenting bodies on all levels). The "burden" of retrieving information on the actual utilities driven from the use or non-use of antibiotics cannot be borne by either the consumers (fruit-eaters), or the producers (farmers). This claim is simply based on the reasons that calculations have not existed in the form demonstrated in this paper (hence, were not obvious for farmers beforehand) and the collection and processing of information has taken the author a long time. Thus, the market is surely handicapped to remove these distortions by its own mechanisms.

Also, **market power** (defined as the ability to alter the market price of a good or service) must be seen to distort the market, if producers attain (full) discretionary powers on the behaviour on the market. Austrian Farmers are to be seen in control of essential resources: Austrian comestibles. But given the fact, that neighbouring countries are also involved in agriculture, this power cannot be judged too highly regarding the consumers. If consumers are scared off by the farmers' ignorance of the outlined facts, and unsprayed fruit is available (e.g. from South Tyrol), the market power of Austrian farmers will be broken. If spraying will go on in Austria and apples will be categorized into 'sprayed' and 'unsprayed' by food retailers, at least in some respect the market will show the consumers' WTP with the help of the contingent valuation of customer reaction (choice). However, if the market does not reward the production of

environmentally sustainable production techniques, the costs will not be internalised voluntarily by the farmers.

Only the measurement of external benefits and costs enables governments to correct coherent market-failures moving to market equilibrium by installing measures to adjust (shadow-)prices to negative external effects, so that these have to be internalised by the economy and by providing subsidies for positive externalities, taking into account monetary benefits for excluded factors.[671] The case is therefore a typical **reason for governmental intervention**.

C8.2. Bargaining Process

Fruit growers retrieve bundled information from the BOV but also from information exchange amongst each other. As for example stated in the [Interview BOV] the information of the severe economic losses caused by FB in 2007 (a heavy FB-year) have made the rounds quickly amongst the fruit growers: DI Greimel from the BOV states in the interview that "[t]he pressure regarding the permission for the use of streptomycin in Austria came from the fruit growers. 2007 there had been clearances. This information travelled among the fruit growers and there was great fear of fire blight posing a threat to their existence and pressure on the BOV has been great to attain [said] permission. From the perspective of the BOV it is also judged reasonable to demand [the use of] streptomycin." Also in the [Interview Global 2000] it is stated by Dr. Burtscher, that (regarding the authorization in 2005 and 2006) "[t]he pressure for permission of streptomycin emanated from Vorarlberg. The Vorarlberger Fruit Growers looked with envy at their German colleagues at the other shore of the lake who were allowed to use streptomycin." It is claimed that although the minister remarked not to authorize streptomycin in early 2005, however it was allowed in Vorarlberg that year. In the "three-country" report on FB ([DBMELV 2005]) it says that it had been allowed for six intensive orchardists (but as mentioned before already no further information is revealed). In the [Interview Global 2000] it is learnt that 19.5 ha (only!) were involved in the exemption of the ban - one really has to ask the questions as to whether these acreages really needed the levering of a European-wide ban?!

The [ORF 01] reports, that "because orchardists in Vorarlberg had suffered severe losses in the past years they campaigned for the authorization of the

[671] [Brent 1996], p. 107

antibiotic".[672] On the occasion of the authorization of streptomycin in 2008 (10th of March until 15th of June) the LKÖ states that "without the authorization intensive orchardists in Vorarlberg would not have survived anymore".[673] This is somewhat exaggerated IMHO, since the organic fruit growers also managed to survive without streptomycin. Mr. Moosbrugger (from the Agricultural Chamber in Vorarlberg) has stated that the Voralberger orchardists would not want to use streptomycin at any cost, but that the agent would only be used where there is no alternative.[674] How could a farmer possibly judge this situation?

In [LKV 01] the following is stated[675]: "After the late authorization of streptomycin in Austria in 2007, which has led to severe damages in Vorarlberg, it seems that one has reacted on the **pressure of the agricultural chambers and the fruit growers associations**" (because the BAES has approved the antibiotic streptomycin 2008). The full-time-fruit growers have clearly achieved what they wanted in 2008 (it needs to be seen whether this was a positive result for them) and the BOV is noticeably satisfied stating that "[t]he aim of the BOV, the achievement of a federal uniform and efficient pest control concept, has been reached" and the Executive Director thanked "BMLFUW, AGES, the Provinces and the representatives of the beekeepers on behalf of the BOV for their good cooperation".[676]

Regarding the authorization for agricultural use of streptomycin the BOV was, according to the information of DI Greimel, involved in the decision process "in close cooperation with the BMLFUW and AGES in the Round Tables, where all stakeholders are represented. By (direct) communication with and hearing of all parties it has been tried to balance the interests of all parties involved. The Federal Ministry decides after this hearing (ultimately bearing responsibility)."[677] Further stating the BOV could take influence on the decision process "[i]n personal contact with the bodies."

Furthermore, the author reckons that the unintelligibly withdrawal of the AMA quality seal for both the streptomycin and the BP treated acreage must have been some kind of "act of reprisal" against the alternative producers, who have been suspected to have caused the media response and the coherent problems of

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[672] [ORF 01] (translated by the author)
[673] [ORF 02] (translated by the author)
[674] [ORF 01] (translated by the author)
[675] Translation and emphasis by the author
[676] [BOV HP] (translated by the author)
[677] Stated by Mr. Greimel in the [Interview BOV]

public awareness (and therefore a relapse for the protagonists of streptomycin). This explanation is undermined by an article of the BOV magazine "Better fruit" [BOV 5_2008] on this issue: the sentence explaining the issue that BP is now subject to the same procedure as streptomycin (clearly causing discontent for bio-ferm) is followed by the statement: "it has also denied having been behind the boycott of the supermarket chains (mentioning that there was a newspaper article, in which an agricultural member of the Styrian government has claimed that producers of alternative products have succeeded to cause the hype (medial response) on the antibiotic issue."[678] It is supposed by the author, that the withdrawal of the AMA quality seal has to be seen to be some kind of payback for this, to suppress future actions. Dr. Donat, (from bio-ferm, the producer of BP) however, quoted in the same article, argues that apparently "beekeepers have found out about the existing biological alternative and have on their part recommended the product (also by press releases) because this constituted a solution for their problems and they could offer the fruit growers an ecological alternative" [679].

C8.3. Assumed Governmental Failures in the Case Study

C8.3.1. Information Failures

C8.3.1.1. "No Health Risk Deriving from Residues in Fruit"

According to [ORF 01] the Styrian Agricultural Economic Chamber argues that the antibiotic is degraded within hours and fruit is **guaranteed to be** free of residues. Also the chairman of the Vorarlberg full-time-orchardists Jens Blum, is cited to **guarantee**, that the apples would be free of residues (he is again of the opinion that it is broken down within **hours**).[680] Presumably this opinion was based on the streptomycin assessment issued by AGES claiming that there are "**no residues** given with the blossom-usage of streptomycin in pome fruit growing"[681]. [ORF 03] reported the Environmental Institute to have proclaimed in September that apples from sprayed areas have not shown to contain residues, but already in September 2008 "knowledge" on the time-span of the breaking down of streptomycin had to be revised. Suddenly it was stated that "to date it

[678] [BOV 5_2008], p. 9 (translated by the author)
[679] [BOV 5_2008], p. 9 (translated by the author)
[680] [ORF 01]
[681] [AGES 18], p. 1 (translation and emphasis by the author)

was assumed that the antibiotic is degraded within a few **days**"[682]: Mr. Zainer from the Environmental Institute stated that "this assumption would now have to be questioned" and that "it is indicated, that this phase takes longer" [683]. The question arising for the author is why it is questioned only now, and why it has not been subject of exact examination beforehand? As stated by Prof. Pittner where streptomycin is sprayed in agriculture, it lacks natural surroundings and the "normal conditions" (formed through evolution) and therefore also breaking down of streptomycin is doubtful. Maybe this is the explanation for the recent findings: on the 14.11.2008 AGES has, for the first time, proved the existence of antibiotic residues in (8 out of 12[684]!) apples, containing between 1.9 and 12 µg/kg[685]. A new method of analysis disproves all the experts' positions (opinions,) claiming that the antibiotic, because it was being used on the blossoms, is not contained in the apples at harvest. The reaction of AGES was (as it might already be expected by the reader) to play down the issue. In its official paper [AGES 19] the agency states that residues were only found in "a few cases" (please refer to the numbers provided above: are 8 out of 12 samples "a few"? This is indeed, without a doubt, the majority!).

Furthermore it is stated that before the new detection method (now revealing the existence of residues), detection limits lay between 0.02 – 0.05 mg.[686] With the allowed residue limit being 50µg/kg[687] with apples, this is just enough to proof the allowed contamination?! What seems strange to the author is the fact, that in honey the detection limit has been 5µg/kg for quite some time. Further it is judged quite alarming that apples have a higher residue limit than honey, given the fact that the per capita consumption of honey is about 1.5kg/year[688] and 28kg/year[689] for apples respectively. AGES states that the "products are safe comestibles and that no risks at all exist when consumed."[690] After the scientific inputs were collected and presented in this paper, and the need to knock over other dogmas already, the author is not so sure about that! Other "scientific" false information has also been proclaimed erroneously: "Girsch[691] sees no danger for the later fruit: this has been confirmed at scientific meetings."[692]

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[682] [ORF 03] (translated by the author)
[683] [ORF 03]
[684] [ORF 04]
[685] [ORF 04]
[686] [AGES 19]
[687] [ORF 04]; [AGES 18]
[688] According to [Interview ÖIB]
[689] [AMA 2008a]
[690] [AGES 19] (translated by the author)
[691] Being the Business Unit Manager of Agriculture at AGES
[692] [LKÖV 01] (translated by the author)

Anyways: as outlined before at least one physician from the biggest hospital in the capital of Austria (AKH Vienna) has been seen on TV by the author to respond negatively to these emergences in the subsequent press conference on the news on residues in apples (as outlined earlier).

Therefore, although §1 GESG rules for AGES that the **precautionary principle** should be considered when aiming for the protection of consumer interests, it is **not realized** and appropriate prevention-measures for "potential" (and surely existing, but not disentangleable to measure the absolute impact (yet)) endangerment is not taken.

C8.3.1.2. Missing Information on the Negative Effects of Streptomycin

As a fact, by the reports available online by AGES the following message is delivered: streptomycin is subject to strict constraints of which NO risk to human health is resulting from: on the homepage of AGES it is e.g. stated, that the usage of streptomycin is "bound to strictest constraints, so that **no danger** the health of human, animal and environment results" and accordingly the BOV transmits this information to the farmers, that there are "**no health risks** to worry about from the usage of streptomycin for the neighbours of fruit orchards".[693] This is simply not true. In contrast to these claims, other scientific opinions have been displayed in depth. Maybe this is even understood by the BOV when it further argues in the same issue that "the calculable risk of streptomycin exertion stands opposite the no longer calculable danger of further exhaustive occurrence of a plant disease endangering national fruit growing in its existence"[694] nevertheless clearly showing, that there is incoherency in information and misinformation regarding the fact that the risks of agricultural usage of streptomycin is calculable and that economic pressure is great. Competent governmental authorities have failed to point out the risks involved with the agricultural use of streptomycin, have missed out on warnings on the hazardous facts of streptomycin, extenuating these and failing to understand and manage risks. This has to be seen in the context of a statement of [Telephone Call Hofer], where the interviewee stated, that Dr. Girsch (AGES) has presented a slide-show on streptomycin with the basic message that it is used internationally, except in South Tyrol, and that streptomycin was "harmless". It must be feared, that this kind of information policy has been addressed by the statement printed in the BOV magazine, that during the meeting on the 29th of April 2008 "many a

[693] [BOV 5_2008], p. 3 (translated by the author)
[694] [BOV 05_2008], p. 2 (translated by the author)

misunderstanding could be cleared up between the representatives of the big chains of the food retailers, AGES, the AMA and the BOV and the understanding for the fruit growers could be improved."[695] The same failure of information is found in Upper Austria [Interview ÖOLVB] Mr. Liedlbauer explaining the case of an orchardist in Goldwörth (being a major supplier of drinking water for the city of Linz) where the "mayor and the community doctor opposed the use of streptomycin" with the result that the applicant for streptomycin was convinced to refrain from the usage, claiming that he had not known about the danger to health.. The same has been achieved in the hometown of the author, where another orchardist, applying for streptomycin in 2008, could be convinced to forego the usage of streptomycin in favour for the organic alternative BP, after introducing the "other side of the coin". It must therefore be assumed, that unbiased information of the orchardists, would result in more understanding of the actual impacts caused, even resulting in voluntary non-individualism as shown in at least these two cases.

C8.3.1.3. Dismissing Alternatives

Dr. Blümel answers the question of the author whether there are other plant protection products effective against FB by stating that "[t]here are other plant protection products achieving comparable[696] efficacy, but only under certain conditions (climate, etc.), however with streptomycin a continuous high effect can be expected." Also Dr. Burtscher in [Interview Global 2000] claims that "AGES continuously transports the information, that streptomycin is the only effective agent there is, which is not true" (shown and discussed in previous chapters of this paper). In his regard "[s]treptomycin seems to be a tranquilizer, but other measures that will lead to containment of the infection pressure will have to be found." AGES itself therefore seems to be conveying the information on the insufficient efficacy of alternatives such as BP and hinders the changeover to environmentally sustainable practices.

C8.3.1.4. Uncommon Information Policy

Given the striking news of (disclaimed) antibiotic residues found in treated fruit AGES provides this information in an article on their homepage saying "Fire Blight Pest Control 2008 - current situation"[697] in a paragraph way down in the respective document (playing down the issue as explained before). The Media has

[695] [BOV 6_2008], p. 3 (translated by the author)
[696] Remark by the author: to streptomycin
[697] [AGES 19]

published much more detailed information than stated by AGES (actually having the actual information at first hand). The procedure is very similar to the communication policy of the Austrian Chamber of Agriculture noted by Mr. Burtscher (Global 2000) in 2008: "on the occasion of the first application of streptomycin to pear trees the heading of the article said "No danger for apple trees". The author can only agree that "[n]ormally you might expect the main news of an article to be contained in the header."[698]

C8.3.1.5. Missing Transparency and the "Public's Right to Know"

The author has to criticise heavily AGES for ignoring the request for information of the author by the "Institute for the Evaluation & Authorization of Plant Protection Products", an important interview partner in regard to this case study. Despite the many efforts of the author of this thesis these were simply ignored and it was not possible to obtain information from this institute at all. The questions provided in the Annex of this study [Interview AGES 02], which the author has addressed to this Institute therefore remain without answers. Only contact with AGES Institute for Plant Health could be achieved ([Interview AGES 01].

Furthermore, in the interview with the BOV, when again it was claimed that "[i]f the substance is used according to the obligations, risk is negligible" and that AGES has also sought the "expert opinion of physicians" the author requested for this expert opinion to be shown, because it has not been retrievable via AGES. DI Greimel answered that the BOV might not be allowed to pass on this expert opinion: "I don't think it is open to the public" - apart from being outdated, because of the residues found in fruit. It is actually completely unclear and very baffling, that this document should be subject to secrecy by AGES and has been unavailable to the author. There is no reason why these assumptions are hidden from the public, since there are also no concerns over "data privacy".

Art. 4 of the **Aarhus Convention**, international law established under the auspices of the UN, ruling the public's right to access information (also known by the public's right to know), must therefore be seen to be **ignored** by the Austrian authorities.

[698] [Interview Global 2000]

C8.3.2. Individualism Failures

C8.3.2.1. Rent Seeking

According to Mr. Burtscher "AGES has always boasted about resisting persuasion"[699] in regard to the authorization of streptomycin. It can only be guessed, what has led AGES to change their minds… …obviously the BOV's (wrong) argument that "[t]he economic risk of a non-application [remark by the author: of streptomycin] is many times higher [remark by the author: than the health risk]."[700]

C8.3.2.2. Regulatory Capture - The ÖPUL-Subsidy Exemption

Interestingly there has been an exemption for the ÖPUL-subsidy in connection with FB: The "ÖPUL"[701]-subsidy is normally only granted to a farm for the total acreage if it exclusively makes use of permitted plant protection agents (named in the positive "IP"-list). But in 2008 the usage of streptomycin, which is of course not allowed on the IP-list, did not imply the loss of the whole subsidy, but only the part of the farming land treated with streptomycin due to special arrangements. Trying to find out who has caused this exemption, the responsibility concerning the ÖPUL has not been easy ascertain. Dr. Blümel from AGES states at [Interview AGES 02] that "[r]egarding the control, handling of payments (and penalizing) of the ÖPUL-subsidy the AMA is responsible". But DI Greßl from the AMA responds (to the author's questions whether the organisation played any role regarding the decision process and which view the AMA takes and above all how the special regulation of the ÖPUL emerged) that the AMA is the wrong point of contact, because the BAES has issued the admission of streptomycin and that the question "regarding the ÖPUL neither the AMA Marketing GesmbH nor the AMA as appointed paying agent are responsible, but the Life-Ministry (BMLFUW)."[702] Mr. Lukas Weber-Hajszan from the BMLFUW then responded to the author confirming the exemption[703] for streptomycin in 2008 (for 2009 the exemption will depend on gathered experience): although streptomycin is not included in the list, (only!) for the acreages with streptomycin-usage no IP-premium (300 € per ha) will be granted. DI Greimel

[699] [Interview Global 2000]
[700] [Interview BOV]
[701] A certain amount depending on the "soil index" influenced by many factors such as climate, height, etc.
[702] See Annex II, "AMA"
[703] Due to the regulations of the "Sonderrichtlinie ÖPUL 2007" (chapters 1.6.10.9 and 1.6.10.10) included in the Annex III.

from the BOV responded on the reasons for this exemption that "[i]t constitutes a compromise between the BOV and the BMLFUW. Background is that fruit growers would have been forced into illegality, because of demoralized reporting behaviour. There were reasonable fears that farmers would have used streptomycin illegally, if the subsidy would have been handled so strictly."[704] Further the interviewee stated that exemptions like these were no common practice. The author judges this exemption to be **perverse subsidisation**.

C8.3.2.3. Regulatory Capture Institutions' Mission Failure

The Minister of the BMLFUW is devoted to the economic well-being of this sector and as learnt in [Interview ÖIB] clearly orientates towards the greatest share of interest groups, which in this case study are found to be the 2600 pome-fruit-farmers rather than the 252 beekeepers living on the honey-production – totally ignoring the economic losses of the 22500 "hobby"-beekeepers and the health risks of the general public (> 8 millions). Insuring the economic safety of a small group of intensive fruit farmers reveals a great preference over the safety of Austrian society as a whole.

Further the assumptions on the information failures ("no health risk deriving from residues in fruit", "no health risks to worry about from the usage of streptomycin") leads to the question why AGES, actually being the institution to ensure Health and Food Safety in Austria, trades these aims off somewhat lightly against economic power.

C8.3.3. Quality of Leadership

C8.3.3.1. Missing Consolidated Data

As pointed out in chapter "C3.4.1. Authorization Procedure for Streptomycin" before, this is all the information that has been obtained from AGES (in the "three-country" reports, criticized before to miss out on ordered and complete data, please refer to the underlined passages in the chapter). Apart from these inputs no more detailed data was available to the author.

a) Missing Consolidated Data on Fire Blight Damage

Because no "Pest Risk Assessment (PRA) for FB was carried out specifically for Austria up to now, as the relevant PRA procedures were not existent in the form

[704] [Interview BOV]

which is applied today at the time when fireblight was first detected in Austria" (as Austria at was not part of the EU in 1993).[705] Asked for data on the economic loss of FB since we have the problem here in Austria, had been answered in the following way: "due to the organisational changes, data (regarding FB infection) of the respective period is not available electronically at AGES (data from EU monitorings are available since 1995 when Austria was recognised as protected zone for FB)"[706].

Asking AGES at [Interview AGES 01] for bundled information on FB occurrence (e.g. on an Austria-wide map) it was stated that "[t]he operation data of the individual farmers with fire blight infections is collected by the Official Regional Plant Protection Service and is only made available to the province authorities, but are not forwarded to the state level under the cover of data privacy protection. Generally there are no problems to bundle national monitoring data for EU surveys on quarantine pests, but the collection of data points for a distribution map on federal level of FB is not possible at present. Therefore there is no detailed national data map of the fire-blight disease for Austria as a whole."

b) Missing Consolidated Data on Authorised Farmers and Streptomycin Usage

The BOV, when asked for a list of the Austrian full-time orchardists with the according size and value (according to their annual crop yield) of their orchards, had no consolidated data at hand, but referred to the Austrian Statistics Office. It has been stated, that classification of the BOV is equal to the one used by the Austrian Statistics Office[707] in combination with a further criterion ("fruit-growing-surcharge"; which could not be worked out by the author in the scope of this paper to adjust the calculation presented above by the author). But DI Greimel judged the author's calculations to "seem to be correct", confirming that "[a]dditional information regarding accumulative data on federal state level is not available to the BOV apart from the Statistics Austria data" at [Interview BOV].

The number of potential applicants for streptomycin (number of full-time orchardists) could also not be obtained by the AGES Institute of Plant Health because it is claimed not to fall in "its area of responsibility"[708] and the question should have been addressed to the Institute for the Evaluation & Authorization of

[705] [Interview AGES 01] Dr. Blümel
[706] [Interview AGES 01] Dr. Blümel
[707] I.e. being 0,15 ha and trees that are planted according to a certain order. A census is conducted every five years.
[708] [Interview AGES 01]

Plant Protection Products of AGES, which unfortunately was not responding to the author. It has therefore been very difficult and laborious to retrieve the data concerning the whole of Austria, because it was not available on a federal level (although it is stated that data is forwarded from the provinces to the federal state level) and the author has refrained from culling data from provincial level for reasons of effort (time constraints). Therefore there **no "official" number** of qualified applicants for streptomycin-use could be retrieved from official sources. The yearly reports on FB in Austria issued by AGES, that include "details on who, when, where, has used which quantities of streptomycin" are claimed to exist by DI Greimel (BOV), but have not been found by the author.

Additionally **data** has been found to be **contradictory** between the Austrian Statistics Office and the Agricultural Chamber. One Austrian Statistics Office reports on the crops of fruit of "extensive orchards"[709] providing the following data:

Table 18: Crops of fruit of "extensive orchards", Source: [Statistik Austria 2007 agriculture]

Year	Apples (in tons)	Pears (in tons)
2003	175.184	8.917
2004	197.703	9.483
2005	219.598	9.746
2006	184.667	7.825
2007	221.458	10.158

But in [LKÖ 03], p. 224 the table "Crops of fruit 2006-2007" (although mentioning the source to be "Statistik Austria, Ergebnisse der landwirtschaftlichen Statistik") draws up the same numbers to be the yield of intensive fruit growing.

Table 19: [LKÖ 03] p. 224, table "Crops of fruit 2006-2007"

Kind of fruit	Total harvest (in tons)		Acreage in ha	
	2006	2007	2006	2007
Apples summer	3.780	3.758	197	197
Apples winter	180.887	217.700	5.863	5.864
Apples total	184.667	221.458	6.060	6.061
Pears summer	2.789	3.484	200	200
Pears winter	5.036	6.674	214	214
Pears total	7.825	10.158	414	414
Total	372.123	446.400	12.320	12.322

[709] [Statistik Austria 2007 agriculture], p. 46, table 4

It must be assumed, that the Statistic Austria Office has lapsed. But the author is somewhat irritated, that data is not convincingly validated and was not available (to the author) by the authorities and had to be retrieved under laborious efforts from partly contradictory sources, requiring the author to draw up his own calculations, because data was not at hand from authorities. This is quite an astonishing fact in times of electronic data processing and again shows the big gap between the possibilities of IT and the real facts. Reasons provided are data privacy, which is not a constraint for the availability of consolidated information: the author did not want to retrieve personal data of certain farmers, but an exact overview on the Austrian situation - and so should the managers!

C8.3.3.2. Absence of Full Social Cost Calculation for Evaluation

Asked for the pre-existence of a CBA within AGES, Dr. Blümel has stated, that the Official Plant Protection Services of some Austrian provinces, but also the Austrian Fruit Growers "have established rather "simple" calculations. Starting from the summation of all pome fruit acreage the cost of crop failure (costs of clearing, income-loss in the year of clearing and the following years, costs of replanting) was apportioned on a hectare-basis to oppose the costs of non-action. Clearly the result was that some action had to be taken."[710]

Hence there is no aggregated data available on the farmers, there is no conclusion on the FB damage caused up to now and clearly no social CBA exists within AGES. Supposedly the risk imposed on society is judged to be at a level considered 'acceptable'.

Also "[o]n the part of the BOV regarding the risk factors of streptomycin no calculations exist. […] Only calculations relating to the economic scope exist, as for example the calculation of Dr. Steinbauer from Provincial Government of Styria, considering the economic loss of fire blight for compensation matters."[711]

C8.3.3.3. Delaying Usability of Alternatives

It has to be remarked by the author at this point that despite the additional criticisms regarding the unavailability of exact data on FB in Austria (as mentioned before (permission procedure of streptomycin) it is noticed that by both the German and the Austrian authorities establishing the annual "three-country"-report on FB seem to have been sleeping on quickly establishing

[710] [Interview AGES 01]
[711] [Interview BOV]

knowledge on useful alternatives. Streptomycin may have created a backlog on the intensive search and refinement of alternatives perceived IMHO reading the FB-Reports of 2003-2007:

Already in the report of 2003 the antagonistic product "BPMC 2023" was found to have an efficiency grade of 77% (with in the same trial "Plantomycin" only reaching up to 71%). The question whether it was to be classified as a plant protection agent or a plant resistance improver (Pflanzenstärkungsmittel) arose.[712] Likewise the author has noticed is that text is repeatedly copy-pasted in these protocols, e.g. the complete text of [AGES RT 01], p.13 is repeated in [AGES RT 02a], p.7, further [AGES RT 01], p.5 = [AGES RT 02a], p.6 and the calls (for a consistent FB host plant rule) have already been postulated in [AGES RT 01], p.18.[713].

In 2004 this question was still not solved and it is postulated, that it should be found out, whether the 4-times application could be reduced without loosing effectiveness, whether forecasting systems could be used to reinforce this effectiveness and whether the combined spraying of yeast-incompatible fungicides could be accomplished[714]. In the conclusion it is stated that results indicate an aptitude (suitability) of yeasts but that these cannot be recommended for practical use. [715] In the Austrian part of the report it is stated, that yeast-preparations are partly very satisfying, but that the dispersion by bees should be modified.[716]

2005 Blossom protect fb, BPASc and Funguran have shown an effectiveness of more than 70%[717] and it is concluded that further efforts in 2006 have to be made in optimising the usage of BP and possible rise of efficiency by a combination of certain products.

In 2006 BP had been found to have an efficiency above 60%, two other yeast preparations even reaching 70% and above, which is stated to be **not** significantly different to the efficiency of "Strepto" – but not supplying any more detailed data and concluding that it has to be examined if this efficiency will be

[712] DBMELV 2003], p. 9

[713] Further examples: [AGES RT 02a], p. 23 = [AGES RT 01], p. 15; one part of [AGES RT 02a], p. 21 is the same as [AGES RT 01], p. 14 and the question in the second paragraph (regarding a possible data privacy issues) has already been postulated in [AGES RT 01], p. 1; [AGES RT 03], p. 9 = [AGES RT 02a], p. 16; [AGES RT 03], p. 8 = [AGES RT 02a], p. 14

[714] DBMELV 2004], p. 12

[715] DBMELV 2004], p. 26

[716] DBMELV 2004], p. 30

[717] DBMELV 2005], p. 15

achieved over several trial years and that the effects on fruit-russeting is to be examined closer.[718]

Research work has been undertaken, but it must be assumed that the procedure would have been different in the absence of the existing possibility to fall back on streptomycin: the hesitating evaluation of possible alternatives is very critical and cautious (an approach missing in judging streptomycin) and is, however, always compared to a measure, that is actually forbidden. Further these measures have only been compared by their efficiency values and not by their true social costs!

C8.3.3.4. Interwoven Institutions (Authorities and Competence Jungles)

The relationship between AGES and BAES is not easy to understand. "AGES partners with BAES and the organisations share the same services, personnel and building."[719] The question arises how an Office (organisation) can "lend" its personnel to another (without actually being the organisation)? Does the BAES only exist "virtually"? Contradictions related to this issue are:

- "The BAES is the competent authority of first instance for the enforcement of the […] Austrian Plant Protection Law 1995 (as per §6 (1) GESG No. 5)"[720]. But also regarding the Institute for Plant Health of AGES it is stated "Enforcement of Austrian Plant Protection Law 1995 as the authority of first instance […]."[721] How can both authorities (BAES and AGES) be authorities of first instance for the Austrian Plant Protection Law 1995? When asked by the author, Dr. Blümel responded that the BAES is the authority of first instance for the Austrian Plant Protection Law 1995.
- Further, whether APSD is subordinated to either AGES or BAES is not apparent because of following contradictory statements found again on the official homepages: "The tasks of the Official Austrian Plant Protection Service at **AGES** […]"[722], then again "Management and coordination of the Official Austrian Plant Protection Service at the

[718] DBMELV 2006], p. 16
[719] [AGES 06] (translated by the author); similarly formulated on [AGES 05]; Legal basis is §6(5) GESG ("Das Bundesamt für Ernährungssicherheit hat sich, um die Vollziehung in der in Abs. 1 angeführten hoheitlichen Aufgaben [Remark by the author: number 4 = Plant Protection Agent Law] zu bewirken, auch der der Agentur zu Gebote stehenden Mittel zu bedienen.")
[720] [AGES BAES] (translated by the author)
[721] [AGES 02], p. 82 (translated by the author); also stated in [AGES 04]
[722] [AGES 05]

BAES […]"[723] further "The tasks of **BAES** are […] Official Austrian Plant Protection Service (APSD)".[724] But the APSD is also found to be listed as a part of the Institute for Plant Health of the **AGES**, but then again stating the APSD "**at the BAES**"[725].

- Dr. Bernhard Url is managing director of AGES and director of BAES[726] appointed by notice from BMLFUW (in agreement with BMFGJ)[727], hence being IMHO a strategic political figure.

The relationship is apparently not only confusing the author: Even the Austrian Chamber of Agriculture[728] states that AGES is the administrative body having authorized streptomycin in Austria (which is actually BAES…). Further in [BOV HP] the Executive Director thanked "BMLFUW, AGES, Provinces and the representatives of the beekeepers on the behalf of BOV for the good cooperation", not at all naming BAES, although actually being the institution issuing the allowance?! This leads to the assumption that BAES is practically not perceived to have an autonomous role in the bargaining process.

Further in [LKÖ 03] it is stated that the "Agricultural Economic Chamber is represented in all AMA Marketing advisory boards. Together with agreements on concrete measures, thereby the strategic alignment towards the quality segment is always minded"[729]. AMA also seems to work closely together with BMLFUW: cited over a hundred times in the "Green report", while AGES (as a comparison) is only cited five times.

The process of attaining listing on the IP-list (necessary for ÖPUL-subsidy) is that the Industry and the Agricultural Chambers suggest plant protection products, these are then evaluated by the Institute of Plant Health of AGES (interestingly not the Institute for the Evaluation & Authorization of Plant Protection Products of AGES), suggesting to BMLFUW to accept or reject the agents on the list (in a reiterative process).

C9. Concluding Remarks and Outlook

Since the agricultural sector can heavily impact and interact with the state of the environment it is therefore crucial to direct the actions of farmers in the best way

[723] [APSD 02]
[724] [AGES BAES]
[725] [AGES 02], p. 83 (translation by the author)
[726] [BMLFUW 02]
[727] According to §6(4) GESG
[728] E.g. in [LKÖ 04] and [LKÖ 05]
[729] [LKÖ 03], p. 96 (translated by the author)

possible. Thus, which information is passed on by competent authorities, and which incentives are given, will be crucial for endowment of a country's public good and "healthy environment".

Already outlined market and government failures interact with the social optimal quantity of innovation, enhancement and dissemination of environmentally sustainable methods.[730] The substance streptomycin (authorized year after year again), has not interfered in the lengthy, laborious and extensive risk-minimizing requirements to minimise risks as per the EU Directive 414/91, and of course can provide a product at a lower price: the research costs are not imposed on the product, but therefore the risk taken is very high! With the use of biological agents, like Blossom Protect, the EU level requirements have been fulfilled and are now only subject to bureaucracy.

The issue of antibiotics used against FB necessarily has to lead to the agricultural sector's awareness of producing what the customer wants (being perceived to not want antibiotics in food production as pointed out by the food retailer Spar and the market study). When there is a lack of good governance, consumer awareness has the power of driving decision processes towards internalising externalities that are burdened on the beekeepers and the customers at the moment.

C9.1. Restoring Austrian-wide Management

Also regarding the compensation payments for the financial losses due to FB (clearing and planting of new trees) there are different schemes in the individual provinces[731] and the advantage of Federalism is dubious. Bacteria do not stop at the borders of the provinces and the plant-pathogen FB is the same everywhere. It does not seem clear why we need nine different regulations and approaches. An Austrian-wide national approach would be more advantageous showing synergy-effects. Capacities to restore the individual laws could be saved (or above all exist), the nationwide handling of compensation payments (or the installation of an insurance against FB) would generate more security and uniformity for the relevant farmers, etc. Further it can only be recommended to intensify the strict eradication of ornamental shrubs host plants (e.g. cotoneaster) at least from public places and within the agricultural sector (according to the

[730] Compare the case in [Jaffe et al 2005]
[731] [DBMELV 2003], p. 18

example of South Tyrol), one of many measures, which additionally will diminish the danger of infection.

C9.2. Related Studies

Also [Heilig et al 2002] tried to demonstrate governmental failure and short-sightedness of the pharmaceutical industry in the use of the antimicrobial "fluoroquinolones", likewise calling for governments to act in the public interest[732] to stop the contributions of bacterial resistance in humans demanding that "[n]ontherapeutic agricultural use of antibiotics should stop while its risks are fully assessed".[733]

[Maumbe 2003] showed a case where better education for farmers and full accounting for the hidden health costs of pesticide use results in better decisions about agricultural pest management of small cotton growers in Zimbabwe.[734]

The article of [Bøgelund 2007] investigates on this reality of policy making (within the policy area of car taxation) trying to find out "how environmental discourses may or may not impact on contemporary policy processes"[735]. According to her article "the existing dominating institutional system related to car taxation deals only superficially and disengaged with the immense environmental problems that face the transport sector of today", rated as being evidence for a system that is robust and resistant against alternative discourses, underlined by the finding that the "Ministry for Finance is still the dominating actor within the field and car taxation is still primarily a matter of yield, growth and welfare." [Bøgelund 2007] has found that "In situations where the environmental question clashes with more essential concerns of the dominating discourse, the dominating actors have successfully acted to encapsulate or roll back the attempts of shaping the tax system according to environmental aims" and that "the economic ministries have been increasingly able to reject environmental demands on the car taxation system; if they have not at the same time served more traditional economic aims".[736]

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[732] For the interested reader: The profit-motivated pharmaceutical industry (Bayer Corporation) reacted in the guise of a trade association of manufacturers of animal drugs and [Heilig et al 2002] state that the Animal Health Institute erroneously claimed that "The assertion that there is increasing evidence that resistance developed in animals is spreading to humans is not true," and it went on to oppose any further restriction on agricultural use.

[733] [Heilig et al 2002]

[734] [Maumbe 2003]

[735] [Bøgelund 2007], p. 79

[736] [Bøgelund 2007], p. 88 et seq.

One of the main strategies identified by [Bøgelund 2007] maintaining the status quo, are:

- **access-denial** of environmental actors "to the central decision-making circles"
- the "**salami method**" which is according to [Bøgelund 2007] used in several policy processes and works by challenging environmental aims by argumentation bound in the old regime cutting off one slice after amputating original proposals and changing the agenda to a more traditional economic agenda
- **delaying tactics** used to "prolong the process or perhaps to wear out environmental actors"
- **jurisdictional power** is a good power base and used for instance to shape the content of directives.

"It is however easier to obstruct, to deny and to delay, if the aim is to avoid rather than to obtain something".[737] and the "broader and more sustainability oriented"[738] environmental issues are framed the more they tend to loose ground, because they need to imply something completely new in existing structures opposing the change.

C9.3. Outlook

In [DBMELV 2008-2012] the strategy paper for FB from 2008 to 2012 Germany draws the conclusion that it is necessary to end the use of streptomycin because of the resulting "residual" risk and the precautionary principle towards the consumer, further claiming, that it is to be assumed that public acceptance for further usage is now only given for a limited time.[739] That was the case even before the antibiotic residues in apples were proven. As a result of the findings of antibiotic residues in apples, Erich Schwärzler (Vorarlberg State Councillor) stated that the results (regarding the residues in apples) would have to be checked and a usage of streptomycin would be reconsidered in 2009.[740] Whether the new findings would have consequences on the use of antibiotic is considered to be doubtful by AGES according to [ORF 04]. The author hopes that the externalities showed in this paper will be borne in mind and both market and governmental failures can be overcome. However, there is a positive development of AGES

[737] [Bøgelund 2007], p. 89
[738] [Bøgelund 2007], p. 90
[739] [DBMELV 2008-2012], p. 5
[740] [ORF 04]

becoming more open by planning to involve experts from all economic areas of the food chain (even naming consumer protection organisation and NGOs) in advisory councils to collaborate on future strategies.[741]

In conclusion, the author subscribes to the view of [Bøgelund 2007] that "[m]ore attention needs to be paid to the institutional setting of the policy-making process if the goal is improved decision making on sustainability" and "understanding of contemporary policy-making, as it looks in real life" is being judged to be a key challenge for ecological economics to implement sustainability in the policy debate,[742] since the "[g]overnment alone cannot provide the basis for making informed decisions about environment and development."[743]

This paper shall be finalized with a statement that an environmental actor in Bøgelund's case study has made: **"to be right is only 10% of success, the rest is the process"**[744].

[741] [AGES 19]
[742] [Bøgelund 2007], p. 80
[743] [Bøgelund 2007], p. 92
[744] [Bøgelund 2007], p. 92

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ANNEX I to the Case Study: Interviews

Prior to the interview the author has declared the reasons for need of inputs:

"The author (Simona Winkler, Linzerstr. 14, 4490 St. Florian) is writing a thesis (in order to attain the academic title "Mag. rer. soc. oec.") on "Interactions between Environmental Law and Economic Power" at the Institute of Industry, Energy and Environment at the University of Vienna (Univ.-Prof. Franz Wirl, Assistant Professor: DDr. Jürgen Noll) and has decided to provide a case study on the contentious issue of agricultural usage of streptomycin against fire blight in Austria including making a cost-benefit-analysis. The paper is written in English."

Furthermore, it has been stated that the acquired information was going to be used to create this case study. In order to distinguish comments and questions by the author from the responses of the interviewees, inputs from the author are written in italics.

Following procedure has been developed during the case study to obtain validated interview inputs:

1. Interview questions in advance per Email (has not been the case with all interviews right from the beginning).

2. The interviews were all held in German.

3. Notes were taken at the interview (the intended recording of the interview with a dictating machine has not been used, partly because the interviews were too long anyway, or held on the phone, partly because it is maybe reminiscent of examinations).

4. The notes were translated into English.

5. The protocol was submitted to the interviewee for revision (also including further questions of re-assurance or problems of understanding).

6. The interviewees' comments on which alterations would have to be done to reach status "approved" were incorporated.

7. The last two steps were re-iterated until…

8. … the approval of the interviewee validating the translation to display the statements in an authentic way and the consent with for printing of the interview in the final version of the thesis were given.

All interviews and telephone calls included in this Annex are approved, except the [Interview AGES 01]: The validation of data has been a laborious process, but has nevertheless been included in its UNAPPROVED status (the author explicitly stating at this point, that the interview is only the last version of correspondence with Dr. Blümel). This "emergency-brake"-procedure was agreed with the assistant professor DDr. Noll (being the supervisor of this paper), because the (incessant) effort to further re-write or change the statements in some way, did not seem helpful in order to carry on with the scope of this paper. Moreover, the actually really important inputs would have had to be retrieved by the other AGES Institute "for the Evaluation & Authorization of Plant Protection Products", which (as pointed out before) has decided to neglect this study.

There was also the possibility for interviewees to remain anonymous, as for example it has been requested by the interviewee of the company Hofer KG, due to "corporate terms of philosophy". The author has therefore published the correspondence without the corresponding data.

1. [Interview bio-ferm]

Company/Institution: **bio-ferm GmbH**
Interviewee(s)/Function(s): Mrs. Dr. DI Christina **DONAT** (Technical Manager, International Registration, R&D)
Interview Location: c/o IFA (Interuniversitäres Forschungsinstitut für Agrarbiotechnologie), Konrad Lorenz Straße. 20, 3430 Tulln, Austria
Date and Time: 16.07.2008, 10:00-11:30 + 04.11.08
Document Status: APPROVED

Author: What is "Blossom Protect" (BP), who produces it and how does it work?

Dr. Donat: Blossom Protect (BP) is an biological plant protection product based on two active ingredients (isolates of Aureobasidium pullulans (Ap.). These are "dematiaceous fungus" isolated from apple trees. The antagonistic microorganisms are growing in the blossoms off apple and pear trees, so inhibiting the infection of the blossoms with Erwinia amylovorum, the causal agent of Fireblight. A possible mode of action is the production of organic acids, this results in a low pH in the blossoms and this low pH is known to be unfeasible for propagation of Erwinia.

BP is produced by the bio-tech company bio-ferm, the company was founded by scientists of the University of Natural Resources and Applied Life Sciences, Vienna.

Author: What is "Aureobasidium pullulans" (Ap.)?

Dr. Donat: A.pullulans is a yeast-like fungi belonging to the group of dothideales, some strains of A. pullulans are used in food technology for the production of "pullulan" (capsules of medicaments, "eatable paper"). Ap. is distributed widely throughout the environment, populating apple trees naturally. It is not genetically modified.

Author: What is the difference compared to the working mechanism of streptomycin?

Dr. Donat: It does not kill the E.a. bacteria, causing accusations, but it must be considered, that therefore BP is also not causing resistances. To oppose the acids produced by BP E.a. would have to change their complete genome (therefore no resistances).

But on the whole the mode of action of both plant protection products is the same: they are both preventive measures. Spraying after infection is too late.

Bacteria directly in contact with the antibiotic are killed, but not all bacterial cells are encountered: if E.a. reaches the blossom, infection proceeds quickly and if bacteria enters the plant antibiotics cannot follow.

Author: What is in your opinion the problem of the agricultural usage of streptomycin?

Dr. Donat: Streptomycin causes plant pathogens resistances (on the E.a.), which is playing with fire! In USA there is meanwhile the (officially, according to rumors more) fourth antibiotic substance in use, because all others are not effective anymore, moving closer to the categories of antibiotics currently used in human medicine.

Author: When and how many times should BP be sprayed, and what is the price for Blossom Protect that a farmer has to spend per year per hectare?

Dr. Donat: The Austrian Agricultural Chamber has established an early warning system (so-called Mary Blight System). But forecasting weather [*remark by the author: regarding the infection conditions for FB]* is extremely difficult, because it is influenced by a few degrees in temperature or a few percents of humidity more or less.

This is why bio-ferm recommends 4 applications of the product, in the different phases of blossoms opening, independently from the weather, to exploit its efficiency to a maximum. But in the end the applicant has to decide when to use the product to protect the open blossoms from fire blight infection. This year more than 90% of the purchased products have not been in use, because of the (adverse) weather conditions.

Dr. Donat: The costs for 4 treatments per hectare is 380€[745] excl. VAT.

Author: What about the fruit russeting of fruits that is sometimes argued to be a drawback of your product?

Dr. Donat: In some years, on some susceptible cultivars it can lead to fruit russeting. But there is no real quintessence gained form statistics. Also other plant protection agents and even water can cause fruit russeting.

Author: What is the result and validity of efficacy studies undertaken for Blossom Protect? The author has found different input on the efficacy of BP (78,4 in [bio ferm 08]; 71% in [bio-ferm 02]; 83,5 % (± 4,2 %) in [Pirklhuber 04_2008])

Dr. Donat: The different values for efficacy data being in circulation are a consequence of which trials are accepted to be valid. Efficiency grades are such instable factors that they should be regarded to by 10%-steps. Stating decimal places is actually doubtable. Overall

[745] According to [bio-ferm04] four intervalled oversprays are recommended during blossom time to optimally protect the maximum number of flowers which do not all open at once but in different (delayed) phases.

Blossom Protect is approximately 10% under the efficiency grade of antibiotics on average.[746]

Author: What are the costs that have to be faced in the notification process (to attain listing to the Annex I of the Directive 91/414)?

Dr. Donat: Laborious and time consuming studies have to be undertaken according to certain (international) guidelines (EPPO-Guidelines, OECD, etc.).

The procedure to attain the listing in Annex I is very costly, and fees have to be paid in magnitudes quite unfeasible for start-up companies and SME (like bio-ferm). Bio-ferm had to pay 145.000€ (2x10.000 basic fee + 2x25.000 examination on completeness fee + 75.000 fee for passing an expert opinion) to the Austrian Health Agency (AGES) according to the Austrian Pflanzenschutzmittelgebührentarif 2008 (PGT 2008) issued by the BAES[747]. Attempts to obtain a reduction were not successful.

Author: Where supporting studies required for each of the two active ingredients separately according to the European regulations?

Dr. Donat: No, but we had to undertake a so-called "bringing study", a very sophisticated "tox study", which resulted in the same result for both strains. One can therefore assume that these two strains are toxicologically evaluated to be the same. Many studies have been carried out with the product (both strains together), how it finally also released into the environments.

Author: What about the current status of approval of BP?

Dr. Donat: All the requirements have been completed as per 2007. In 2008 the Austrian Health Agency has taken over the rapporteur status for BP, entailing a waiting time of approximately 3-5 years for the notification-process, to complete the inclusion in Annex I *[remark by the author: of the European Directive 91/414/EEC]*.

Author: In which countries is Blossom Protect used?

Dr. Donat: In some countries (as for example in Austria, Slovak Republic, Hungary, Slovenia) an "emergency use -permission" has been given in the last years. In Germany the product has an authorization as a "plant strengthener". That's something like a fertilizer. Only the Germans have maintained this loop-hole from the EU Directive *[remark by the author: 91/414/EEC]*. And Austria has adhered to it: all products authorized in such a way *[remark by the author: in Germany]* are allowed to be placed on the market here *[remark by the author: in Austria]* as a fertilizer. The other MS are not very happy about that- this is why it [*remark by the author: this arrangement*] is constantly on "shaky ground". As a fact we would have also been allowed to sell BP as a fertilizer in Austria. The disadvantage is: one is not allowed to promote with "efficiency against" [*remark by the author: for example "fire blight"*] and [*remark by the author: the agent*] is placed on a list with quite esoteric agents.

Author: Has BP been on the IP-list?

Dr. Donat: BP has been on the IP-list and also on the list for organic farming during the danger-in-delay authorization period.

Author: What about other viable plant protection products?

Dr. Donat: There are no other antagonist plant protection agents dealing with fire blight as effectively as BP does.

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[746] Remark by the author: The current studies on the efficiency grade available have been sent to the author by email [bio-ferm 09].

[747] [BAES 03]

Interposed question by the author: What about "BPMC 2023" for example stated in [DBMELV 2003]?

Dr. Donat: This has been another formulation of Blossom Protect (in its trial denomination at that time).

Author: Please state on following Input-Factors for the Cost-Benefit-Analysis of my paper:

Factors questioned by the author	Answers given by Mrs. Dr. Donat
Risks involved with application of the plant protection agent	None, because there are finished studies proofing this
Safety measures to be taken working with the plant protection agent?	There are safety measures to be taken – please refer to the label [bio-ferm 10]. One part of these instructions is obligatory, simply because it concerns plant protection agents, for example the matter that is has to be disposed as special waste. Nobody would dispose baker's yeast as special waste, but as soon as it is sold as a plant protection agent… Another part is obligatory, because it is a microorganism, having to be labeled with "R42/43" (according to the EU) According to present study results there are no risks, but please refer to the details provided on the package.
Costs of additional technical prerequisites	Normal spraying device, no additional appliances afforded
Toxicity studies	Done according OECD, EPA, EPPO
Risk factor resistances	None
Testing of honey	Not required
Disposal of honey	Not required
Compensation for beekeeper	Not required

Author: The food retailers have protested against the use of streptomycin because of worries that the apples could contain residues of streptomycin.

Dr. Donat: From the scientific point of view this is nonsense. Neither Streptomycin nor Blossom Protect will be found on fruits, because both products are used during blooming. The reason why food retailers worried about that is not clear for me. However, most of them decided to sell only fruits with AMA quality label, and so they passed the topic to AMA management.

Author: Why was the AMA quality label at the same time withdrawn for acreages treated with Blossom protect (unless it was proved, that BP was not to be found in the apple - of course entailing costs)?

Dr. Donat: I did not understand why.

The AMA quality label guarantees in its constitutions that the label will be only on products which follow the guidelines of integrated plant production (IP). There is a list of plant protection products which are allowed to be used under this guideline. Blossom Protect was on this list, Streptomycin not. Nevertheless the quality label was withdrawn from both products. They gave two arguments:

1. The products have only emergency use permission.

This was correct, but altogether 11 plant protection products were on the market under this permission, AMA withdrew the quality label only for the products to be used against fire blight.

2. Possible residues on fruits. AMA stated in spring 2008 that fruits will be investigated from AMA concerning residues of both products, and if no residues will be found the labels will be restored.

As explained before this nonsense, there will be no residues. Besides this the microbial antagonists that are the active substance in Blossom Protect are harmless: in studies it was shown that mice can eat the highest biological possible dose which is 2000mg/kg body weight without showing any symptoms.

There were no investigations done for Blossom Protect, and the label was not returned till now (November 2008).

Of course for farmers using BP (being a harmless substance) it is a severe problem if they have to face the problem of potentially not obtaining the AMA quality seal.

Author: Why is the bargaining power of the agricultural sector so immense to lever out valid ban of the agricultural use of streptomycin, law to protect human health safety?

Dr. Donat: The bargaining power of the agricultural sector (regarding the GDP and employment) has to be seen rather historically. But the farmers own property: this is Austria!

Author: What is the future outlook in your opinion?

Dr. Donat: FB is everywhere and we will have to learn to live with it, as with other plant diseases, too. And we will have to use plant protection agents that do not endanger the environment (and human health) to excessive extent. There are so many plant diseases or damages caused by weather conditions like hail that it cannot be to rely on loop-holes in law forever.

Author: Is there anything else you would like to state?

Dr. Donat: No

Author: Thank you very much for the interview!

Documents received: [bio-ferm 08]; [bio-ferm 09]; [BAES 03]

2. [Interview AGES 01]

Company/Institution: Austrian Agency for Health and Food Safety (**AGES**), Institute for Plant Health
Interviewee(s)/Function(s): Mrs. Univ-Doz. Dr. DI **BLÜMEL** Sylvia (Director of the Institute for Plant Health, I-PGH), Mrs. DI **PERSEN** Ulrike (Assistant Department Head of Department of Phytopathology in Fruit Production & Viticulture, being part of the I-PGH)
Interview Location: Spargelfeldstrasse 191, 1220 Vienna, Austria
Date and Time: 24.07.08, 14:00-15:30 (Blümel; Persen) and 02.10.08, 10:00-14:00 (Blümel)
Document Status: **NOT APPROVED -** the yellow highlighted passages, though, are directly inserted by Dr. Blümel in this latest version of correspondence.

Dr. Blümel: Austria is still being recognized as being free from E.a. (pest free area)[748], hence obliged to take measures in accordance with the relevant FAO International Standard for Phytosanitary Measures[749] (having binding character) according to the Council

[748] Remark by the Author: but there is a new EU regulation 2008/690: for Austria the recognition as of the protected zones could soon be cancelled. It will be sent to the author; Status: done

[749] Remark by the author: [FAO 2006]

Directive "2000/29EC", also scheduling the use of plant protection measures, without explicitly designating individual products, but recommending a bundle of contra-actions.
Dr. Blümel: Austria, as all EU member states have to send annual monitoring reports to the European Commission.

Dr. Blümel: But the loss of the recognition of the status as a protected zone (for Fireblight), does not change the status of FB as quarantine organism: once the quarantine status has been held, it is not lost, unless there is general decision within the EU to remove a quarantine pest from the annexes of the EU-directive 2000/29/EC.

Author: Which measures exactly does the FAO/IPPC regulate concerning the combating of fire blight (mentioning the use of streptomycin or other plant protection agents)?

Blümel: Measures are not defined in specific detail (e.g. recommendation of plant protection products). It is always only referred to "appropriate measures" to be taken.

Author: What about the PRA that is usually foreseen to be calculated by standards laid down in the ISPM's (international standards for phytosanitary measures [FA0 2006]) for FB?

Dr. Blümel: No Pest Risk Assessment (PRA) for FB was carried out specifically for Austria up to now, as the relevant PRA procedures were not existent in the form which is applied today at the time when fireblight was first detected in Austria. It must be considered that Austria at that time had not yet joined the EU. When Austria had joined the EU and when the relevant EU-directives for Plant health had been implemented the necessary and obligatory measures which are layed down in the relevant EU legislation were applied.

[Dr. Blümel: (Frau Winkler bitte beachten Sie, dass hier meistens keine konkreten Angaben gemacht werden, sondern auch z.B. Verweise auf anerkannte Methoden der EPPO oder andere publizierte und agreed methods gemacht werden oder einfach auch auf angemessene, anerkannte und wirksame Methoden allgemein verwiesen wird, die die einzelnen EU Mitgliedsstaaten umsetzen sollen; d.h. die Mitgliedsstaaten übernehmen die Verantwortung dafür, dass die von ihnen gesetzten Massnahmen wirksam und angemessen sind)]

Dr. Blümel: When the AGES was formed in 2002 the Institute of Plant Health was constituted as a new organizational unit by the transfer of parts of the former Institute for Phytomedicine. Due to the organisational changes data (regarding FB infection) of the respective period is not available electronically at AGES.(data from EU monitorings are available since 1995 when Austria was recognised as protected zone for FB).
[Remark by the author. It has the,refore been set aside to quest for data dating back so far:] it is not possible to consolidate the infection development (and the damage caused since 1993) in the scope of this paper.

Dr. Blümel: Due to this new formation of the AGES in 2002 the formerly Institute of Phytomedicine, which has been working on holistically plant health concepts, with 50 employees has been replaced by the Institute of Plant Health with a staff of 30 persons, now mainly responsible for the monitoring, detection and laboratory diagnosis and PRA of quarantine pests.

Author: What is the role of the I-PGH regarding the combating of fire blight in Austria?

Dr. Blümel: The Institute for Plant Health is (inter alia) responsible for monitoring, control-measures of the causative agent (for example training courses) and pest risk analysis.
DI Persen: On behalf of fire blight in Austria Round Tables are organized by the AGES Institute for Plant Health regularly. The fireblight round tables can only be attended on invitation and and are usually attended by members of

- 2 bee-organisations,
- organic fruit growers association,
- BOV (Federal Association of Fruit Growers)
- Consultants (Originalausdruck war "Berater")
- Chambers of agriculture (9)

- Agricultural experimentation center (FA 10B Referat APSD), Graz
- Attorneys of the provincial governments
- BMLFUW
- In case of research-round-tables all research partners.

Author: In the author's opinion the following tasks of the Institute for Plant Health, translated from the document [AGES 02], could (eventually) be agreed on (?) with Dr. Blümel:

1. Enforcement of Austrian Plant Protection Law 1995 as the authority of first instance and Austrian Plant Protection Regulation 1996
2. „Evidenzführung und Auskunftserteilung aus Warndienstuntersuchungen in allen Bereichen des Pflanzenschutzes."[750] = *does this e.g. comprise the Mary blight system?* Dr. BLümel; NO, a number of other pests, such a sharmful arthropods and fungi.
3. Development of recommendations, statistics, expert opinions for material law (GESG, PSG, PGG, SGG), guidelines, norms and of parliamentary inquiries for ministries and the EC.
4. implementing relevant EU regulation and directives (e.g. 2000/29/EC)
5. National coordination authority for the implementation of measures necessary according to the EC monitoring
6. analysis, risk valuation, risk analyses and risk communication regarding plant health as per PPL
7. plant protection agent testing (concerning fire-blight only taking place in the laboratory or glasshouse under special quarantine conditions and terms, because Austria is still a protected (quarantine) zone[751])
8. consultancy for the provinces
9. detection and monitoring of occurence and dissemination of plant pests and diseases
10. research on the biology and control-measures for epidemics (for example training courses),
11. Technical representation of Austria, BAES and AGES in (inter-)national committees and organisations.
12. Development of integrated and organic plant protection strategies, in particular emergency plans for quarantine pests and diseases.

Author: What is the relation between the BAES and the AGES?
Dr. Blümel: Tasks of the BAES cover issuing orders (as a federal office) to the AGES but also externally to customs authorities (e.g. regarding import controls), but the BAES itself does not perform analyses or other functional tasks and the decision competences and responsibilities are separated.

Author: Is the AGES or the BAES authority of first instance for the Austrian Plant Protection Law 1995?
Dr. Blümel: The BAES

Author: What is the scientific advice given specifically regarding FB exactly? Is there a conclusion document?
Sg. Frau Winkler: das war ein schriftlicher nachträglicher Kommentar von mir; bitte extrahieren die Information auf die ich verweise ; Dr. Blümel: Take a look on the AGES website. All information which is presented there with the different documents e.g. research-round table is AGES scientific and technical advice; but also all the recommendations which are derived from the different research projects of AGES on fireblight (see also the ppts. of the round table).

Author: Does a Cost Benefit Analysis already exist in your organisation?
Dr. Blümel: the Official Plant Protection Services of some Austrian provinces and (nicht together, jeder hat seine Zahlen getrennt zusammengestellt) the BOV have established

[750] Remark by the author: [AGES 02], p. 82
[751] In Austria (unlike Germany) outdoor tests are not allowed in yet because of the status of a quarantine zone.

rather "simple" calculations. Starting from the summation of all pome fruit acreage the cost of crop failure (costs of clearing, income-loss in the year of clearing and the following years, costs of replanting) were apportioned on a hectare-basis to oppose the costs of non-action. Clearly the result was that some action had to be taken.

Author: Is this cost-calculation (BOV-article estimating the possible damage fire-blight could cause, available by your Institute?
Dr. Blümel: No. *???Ich hatte Sie auf eine/mehrere Presseaussendungen bzw. Zeitungsartikel dazu vom letzten Jahr verwiesen und erwähnt dass es mich einige Zeit kosten würde diese auszuheben; ich habe nicht gesagt, dass diese Presseaussendungen bzw. Zeitungsartikel gar nicht bei uns verfügbar wären)*

Author: Are bundled Austria maps available for the years since first dealing with Erwinia amylovora, making the areas infected with fire-blight visible?
Dr. Blümel: The operation data of the individual farmers with fire blight infections is collected by the Official Regional Plant Protection Service and is only made available to the province authorities, but are not forwarded to the state level under the cover of data privacy protection. Generally there are no problems to bundle national monitoring data for EU surveys on quarantine pests, but the collection of data points for a distribution map on federal level of FB is not possible as present. Therefore there is no detailed national data map of the fire-blight disease for Austria as a whole.

Author: Please describe the process of approval and the reasons for approval of streptomycin although banned in EU and Austrian law?
Dr. Blümel: I must refer you to the Institute for the Evaluation & Authorization of Plant Protection Products of the AGES.

Author: What is the role of the AGES regarding the approval of streptomycin?
Dr. Blümel: The other Institute will have this information available. It is also in charge for the calculation of ecotoxicological (etc.) risks.

Author: How are the risks of illegal spraying of streptomycin estimated?
Dr. Blümel: controls of the use of streptomycin take place by the Plant Protection Services of the Provinces via random inspections following a raster (or in case of suspicion) and in operating controls. Information exchange takes place regularly between the Plant Protection Services of the Provinces, the agricultural chamber(s) and the AGES/BAES in coordination meetings.

Author: Are there other plant protection products effective to combat fire-blight?
Dr. Blümel: There are other plant protection products achieving comparable[752] efficacy, but only under certain conditions (climate, etc.), however with streptomycin a continuous high effect can be expected.

Dr. Blümel: There are a number of international and national research projects including tests with alternative plant protection products to control FB and there was one national research project in which some "hobbyists' homebrew remedies" (e.g. colloidal silver, herb mixes, etc.) were tested and results are published in the round table protocols.

Author: What is the contribution of the Institute for Plant Health, AGES (I-PGH) regarding the ÖPUL–(positive)-list?
Dr. Blümel: The process is following: Industry and Agricultural Chambers suggest plant protection products to be evaluated for an approval for the ÖPUL lists to the BMLFUW. The Institute of Plant Health (AGES) is authorized by the BMLFUW to carry out the evaluation of the PPPS and to recommend acceptance or rejecttion to the BMLFUW (reiterative process; evaluation process according to an evaluation scheme). Usually the §13-agents (permission on exemption) are not on the IP-list at the time when the recommendations annual lists is established.

Author: But Blossom Protect is on the IP-list 01.03.2008-30.04.2008 and 01.05.2008-30.06.2008.

[752] Remark by the author: to streptomycin

Dr. Blümel: Regarding the control, handling of payments (and penalizing) of the ÖPUL-subsidy the AMA is responsible.

Regarding the structure of the CBA:
Data of number of full-time orchardists cannot be obtained by the AGES (only data on the total amount of cultivated land). Frau Winkler: es ist einfach nicht die Aufgabe der AGES Statistiken über die Anbauflächen zu führen.
These data are forwarded from the Provinces to the Federal state level.
Dr. Blümel: Bitte klären Sie das nochmals ab; in manchen Bundesländern gibt es auch Erhebungen durch die Landwirtschaftskammern.

The number of potential applicants for streptomycin is not available at the I-PGH and the question has to be addressed to Institute for the Evaluation & Authorization of Plant Protection Products of the AGES.

The probability for FB-infection is not calculable, because of the numerous influencing factors amongst them: climate conditions in general, especially of previous winter, temperature during the infection period, humidity during the infection period, rainfall-quantity and incidence, hail, wind, impeded drainage, potential vectors, susceptibility of host plant species, infection pressure in the orchard and adjacent vegetation, composition of adjacent vegetation (host plants) etc.

Dr. Blümel: The latent infection by fireblight which might be present in an orchard is not known for each orchard.

All these facts together up to now cannot be standardized. Therefore there are no data on the average infestation rate of orchards with FB in Austria (but not only in Austria) and according to Dr. Blümel it does not seem feasible to try to calculate average infestion rates (in the scope of a thesis). But maybe the BOV has more details.

The scenario of "non-action" is not calculable, because a certain situation has to be assumed as basis: measures that are obligatory to be taken (mechanic operations: Removal or cut-back of infested plants) as soon as FB is discovered because it is a quarantine-pest (the status of FB being a quarantine organism for the EU remains unchanged, although it might loose it's status as a protected zone → The loss of the recognition of the status as a protected zone for Austria implicates that it will also have to accept imports from tree nurseries that not from areas of production subject to certain conditions).

The division into IP and organic would be most advisable as it seems (skipping the extensive meadow orchards (scattered fruit-trees) because of too great uncertainty, just as private gardens, public places and nurseries).
Cultivation measures alone as effective control measure could be applied until 30% infestations rate, for infections rates higher than 30% the application of PSM could be assumed (difference in organic farming/IP).

Further regarding the input factors of the CBA should be considered:
Cleaning of the spraying equipment
- Emptying of the tank and filling the residues into special canisters.
- Protective clothing
- Working time

Regarding the price of streptomycin:
- Important to refer to ready-for-use dilution (% of streptomycin)
- Amount of product in amount of water and application rate in the field (amount of water sprayed to the plants)

Regarding the administrative costs for issuing conditions, sending these to the provinces etc. data are hard to be retrieved – the inspection costs of the Provinces might be easier to obtain, because they have their staff assigned to these tasks quite specifically.

Further spoken about:
Updated AGES homepage (e.g. new document on streptomycin (oct.08)

Author: Thank you very much for the interviews!

Documents retrieved: [AGES 14]; [AGES 15]; [AGES 16]; [AGES 17]; [EPPO 02]; VERORDNUNG (EG) Nr. 690/2008 DER KOMMISSION vom 4. Juli 2008; Flyer of EPPO-Colloquium on the 25.09.2008 at AGES, 2 pages;

3. [Interview OÖLVB]

Company/Institution: Österreichisches Imkereizentrum - Oberösterreichischer Landesverband für Bienenzucht (Austrian center for beekeeping – Upper Austrian Provincial Association for beekeeping, **OÖLVB**)
Interviewee(s)/Function(s): Mr. Hofrat Mag. **LIEDLBAUER**, Maximilian (Chairman)
Interview Location: Voglgutstraße 1, 4484 Kronstorf, Austria
Date and Time: 25.07.2008, 09:00-12:30 and Telephone Call on 13.11.2008
Document Status: Approved

Author: Please provide some background knowledge about the beekeeping industry sector in Austria:

Liedlbauer: Formerly all Austrian beekeepers were organized under the "Austrian Beekeeper Confederation" ("Österreichischer Imkerbund" (ÖIB), presided by Mr. Josef Ulz), with sub-divisions in all 9 provinces of Austria (for hobby beekeepers) and a tenth sub-division for the full-time beekeepers. Because of controversies this organization has been remodeled. The ÖIB is now the organization only for beekeepers not depending on the apiary income.

Full-time beekeepers have built up their own union, now called the "Austrian Full-time Beekeepers Conferderation" ("Österreichischer Erwerbsimkerbund" (ÖEIB), presided by Mr. Josef Stich) and also joined the "European Professional Beekeeper Association".

Because of the administration of subsidy-programs it was necessary to build an umbrella organization, called "Bee Austria" ("Biene Österreich" (BÖ), with Mr. DI Christian being the managing director Boigenzahn).

EU-Programs (subsidies) supporting beekeeping are negotiated by the BMLFUW, but operated by the AMA, which is the respective authority in charge of controlling, disbursing, and amercing (also with regard to all other agricultural subsidies), also involved with PR for the sector.

Beekeeping is more a hobby-sector in Austria and that there is not much economic power.

Author: What are your experiences, what is your point of view concerning fire blight and the use of streptomycin in (Upper) Austria?

Liedlbauer: Starting in the year 2000 fire blight has been a topic for the beekeepers in Austria. A person from the Chamber of Agriculture in the Tyrol claimed that the "bees were to blame for the dissemination of fire blight" – although no evidence could be adduced. This brought about FB regulations in all provinces, willing a 48 hours quarantine before a bee-hive is allowed to be moved. In Upper Austria this regulation has been suspended again, because the measure showed clearly that bees cannot be (if any) the only effect.

Since 2002 the topic has been held in abeyance (from the viewpoint of the beekeepers) until on the 18.12.2007 the Upper Austrian Chamber of Agriculture (LKOÖ) invited to a meeting indicating that 2008 streptomycin will be used and what consequences this will bring for beekeepers.

Interestingly although 2007 the Styrian fruit growers claimed to have faced a very intensive fire blight year, the harvest was stated to be the "best ever" by a chamber-staff

member. An explanation could be the rigorous pruning back, which can trigger the fruit production of a tree and hence the crop obtained.

Mrs. Mag. Almuth Leitner from the "Amt der Oberösterreichischen Landesregierung" was in charge with the formulation of the regulation

The LKOÖ, Department for Crop Production consists of

- Mr. DI Christian Krumphuber (Director of Crop Production Department),
- Mr. Ing. Heimo Strebl (Upper Austrian Fruit Growers) for vegetable and fruit.

Responsible for plant health in general: Mr. DI Hubert Köppl, being the APSD-staff of the LKOÖ. The APSD actually is a Federal (state) duty which is out-sourced in Upper Austrian to the LKOÖ (e.g. having the Maryblight™ wheather forecasting prediction system under control and being in charge for the publication of recommendations on the basis of the computer forecast).

This double function of normal staff members of the chamber (actually for representing interests of the farmers) on the other hand APSD in Upper Austria (in contrast to e.g. Styrian organisation where the APSD is not incorporated in the agricultural chamber but performed by staff of the province authorities).

The Upper Austrian Chamber of Agriculture is funded by membership fees only by one third. The rest is remunerated by the Federation (state level) for consultancy activities and dealing with subsidy-allocation.

With the bundling of various Federal Offices into the AGES, the Institute for Apiculture (Director Mr. Dr. Moosbeckhofer) has been reduced to only one full-time and two half-time jobs, only being in charge for bee epidemic (control) in contrast to former times when it was also responsible for research work and laboratory testing. Today this work is only available on payment. Because historically these tasks were fulfilled by the state (but not any longer making the resources available in the AGES) private companies are still missing out and research assignments are normally still placed at the AGES. The AGES has not enough financial resources anymore: many (dispersed) Federal Offices were shut down.

For this reason the OÖLVB has bought an instrument for the detection of streptomycin in honey-samples for its "Center of beekeeping" in Linz for 30.000€ in 2007, so that these residue-tests can be made independently (and not anymore by the AGES). The Province Authority has recognized these tests.

From my viewpoint the EFSA and AGES are to industry-driven and their risk assessments of pesticides concerning the agreeableness of honey-bees is insufficient.

Excursus: Mr. Liedlbauer also refers to a study by Prof. Tautz from the University of Würzburg[753] (Institut für Zoologie, beegroup) which has partly (and in German translation) been published in a technical beekeeper journal in Germany ("Imkerei-Technik – Fachzeitschrift der Berufsimker in Deutschland"). The subject matter is also discussed because of recent problems of sudden deaths of bees in, linked to be a result of maize seed treatment with clothianidin (a pesticide against the Western corn rootworm).

Regarding the information flow it is claimed that there have not been any information events from the AGES for the OÖLVB (i.e. no information regarding the epidemiology of fire blight, alternative combating methods, etc.). Although an association member is sitting in the meetings "Round Table" no information has reached Upper Austria in this concern.

[753] Bienenforschung Würzburg e.V., Prof. Dr. Jürgen Tautz (Uni Würzburg), tautz@biozentrum.uni-wuerzburg.de, http://www.beegroup.de/

The author informs briefly on antagonistic plant protection agents and their efficiency grades etc. (e.g. also the possibility to disperse Blossom protect via honeybees).

Liedlbauer: I am aware that, the AGES (Institute for Apiculture, Mr. Dr. Moosbeckhofer) has tested Blossom Protect against fire blight, but there was (unfortunately) no practical result.

The application of BP via bees is interesting, but may not always be advantageous since the bees will always take their way to the most attractive food source: if e.g. rape is available bees will fly there and not to the orchard. But BP can also be sprayed (just as other plant protection products).

Author: please report more on the situation in Upper Austria:

Liedlbauer: In Upper Austria there are 85 full-time orchardists. Nine of them have applied for the allowance to use streptomycin in 2008, with only two having sprayed it eventually.

One of the applicants was situated in Goldwörth (a major supplier for drinking water for the Upper Austrian capital Linz). In response beekeepers concerned with the contingent spraying had announced their moving away with the bees. The mayor and the community doctor opposed the use of streptomycin, too. The farmer has refrained from streptomycin-use voluntarily, conceding that he "did not know, that it was so hazardous to health".

Author: Is there a regulation that forces beekeepers to test their honey? What is your estimation of the propability of dispersion of streptomycin-contaminated honey?

Liedlbauer: There is no law regulating that the beekeepers HAVE TO undergo laboratory testing with the honey produced. But members of the OÖLVB have to send in samples of their honey in order to receive the Upper Austrian quality label. Further all members of the OÖLVB from critical zones are tested. Beekeepers who are not organized via the OÖLVB are contacted by the local authority informing them on the necessity of laboratory testing, but there this is not regulated by law. Another problem of this communication is, that staff working in the local authority do not know these "black sheep". It is more probable that members of the OÖLVB know non-organised beekeepers and persuade these few to make their way to the local authority.

Asked for the risk of untested honey being consumed although streptomycin residues are too high is judged by Mr. Liedlbauer to be "very low"*.*

Author: How high are the costs?

Liedlbauer: Because there is a law allowing the farmer to use streptomycin, the farmer has the right to do so and can not be sued by the beekeeper to cover these costs. This is why the provincial authorities take over the costs. But it is only an agreement under private law and not even signed by an authority.

The promised compensation for contaminated honey by the Province Upper Austria will be 5€/kg.

The costs for the residue-tests are also promised to be carried by the Authority, with 75€/tested sample.

2008 there were only 23 examinations (all of them negative).

Samples are taken in the following way: from one location of bee-hives in a critical area all honey are mixed. In Upper Austria every location within a sprayed area is monitored, in the other provinces according to the monitoring plan elaborated by the AGES.

Author: What are your future visions, suggestions to find a sustainable solution?

Liedlbauer: I see a possibility that the Upper Austrian Environmental Bar[754] of the Provincial Authority might have the resources to fill this gap of information forwarding regarding alternatives and other information on fire blight. The Upper Austrian Academy for Environment and Nature (OÖ. Akademie für Umwelt und Natur, Kärtnerstr., Linz, Director DI Wolfgang Rescheneder) may even be an recognized partner with enough resources to organize meetings for the discussion of alternatives.

Author: Are there any further comments you would like to state?

Liedlbauer: At the meeting (18.3.2008, 19.00 Uhr LKÖ) in Wels, Upper Austria with on the one hand bee keepers and the fruit growers concerned, alternatives have not been discussed. The fruit growers are of the opinion that: "alternatives do not work and cause fruit russeting", and that the only solution is spraying (*Remark by the author: of antibiotics*).

Author: Thank you very much for the interview!

Documents/Information obtained at interview: [OÖLVB 2007]; [DORIS]; [Frühwirth 2003]; [OÖLR 01]; [Vereinbarung Punktation Stand 18.3.08]

4. [Interview Global 2000]

Company/Institution: **Global 2000**
Interviewee(s)/Function(s): DI Dr. Helmut **BURTSCHER** , Biochemist
Interview Location: Neustiftgasse 36, 1060 Vienna, Austria
Date and Time: 05.08.08, 10:45- 12:00
Document Status: APPROVED

Author: Please state your view of and opinion on the agricultural use of streptomycin.

Dr. Burtscher: Regarding the developments in Switzerland permitting the use streptomycin: There were strict clearing rules for infected trees in (extensive) fruit-tree meadows. But there has been an incident of a farmer who has refused to remove an infected peartree. Legal action was taken, going through the stages of appeal, conceding right to the farmer in the end: he did not have to clear the tree. This new legal situation brought about higher infection pressure, therefore higher risk for orchardists, which has led to making the position worse of those being in favour for consequently pruning their trees instead of using antibiotics and might also explain the allowance of streptomycin in Switzerland in 2008.

The authorization on to use streptomycin in Germany 2004 through the loop-hole "danger in delay" has been given by the German Agricultural Minister Mrs. Künast from the Green party!

In February 2004 there was following situation in Austria:

§12(10) PSMG 1997 ruled, that all plant protection agents allowed for in the Netherlands would also be allowed for in Austria. At that time the Netherlands had for reasons of provisional regulation to clearance sale Plantomycin (today "Strepto") for one more year.

Hence, streptomycin at that time was available freely on the market without control in Austria, actually by mistake. (Mr. Pirklhuber asked Minister Pröll in a parliamentary inquiry

[754] Oberösterreichische Umweltanwaltschaft: http://www.land-oberoesterreich.gv.at/cps/rde/xchg/SID-9B305832-2DF014E2/ooe/hs.xsl/ooe_uanw_DEU_HTML.htm

which plant protection products exactly were now allowed by this equalization with the Netherlands. Minister Pröll refered to a dutch internet-homepage (The Standard reported). Global 2000 found out, that amongst many hundred other "dutch" pesticides amongst others there was also a streptomycin-agent (Plantomycin), which some in Austria wanted to use against FB, but was not allowed in Austria and recently forbidden by the EU. In Holland it was at that time allowed because of the clearance sale-respite. Because Global 2000 pointed this out to Minister Pröll in a ZIB1 conference streptomycin was then placed on a prohibition-regulation.

In Austria only agents are allowed, that explicitly have an authorization. But there is also a list explicitly naming forbidden agents:

„Langtitel: Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über das Verbot von Pflanzenschutzmitteln, die bestimmte Wirkstoffe enthalten
StF: BGBl. II Nr. 308/2002
Änderung
idF: BGBl. II Nr. 128/2004
Präambel/Promulgationsklausel
Auf Grund des § 17 des Pflanzenschutzmittelgesetzes 1997, BGBl. I Nr. 60/1997, in der Fassung des Agrarrechtsänderungsgesetzes 2002, BGBl. I Nr. 110/2002, wird verordnet:

§ 1. Pflanzenschutzmittel, die

1. einen der im Anhang der Richtlinie 79/117/EWG des Rates vom 21. Dezember 1978 über das Verbot des In-Verkehr-Bringens und der Anwendung von Pflanzenschutzmitteln, die bestimmte Wirkstoffe enthalten (ABl. Nr. L 33 vom 8. Februar 1978, S. 36), in der jeweils geltenden Fassung, genannten Wirkstoffe,
2. den Wirkstoff Azocyclotin, Carbaryl, Cyhexatin, Kasugamycin, Paraquat oder **Streptomycin** oder
3. Bariumverbindungen

enthalten, gelten als nicht zugelassen und dürfen nicht in Verkehr gebracht werden.

§ 2. Pflanzenschutzmittel gemäß § 1 dürfen jedoch in Verkehr gebracht werden, soweit sie gemäß § 13 (Zulassung bei Gefahr im Verzug) des Pflanzenschutzmittelgesetzes 1997, BGBl. I Nr. 60/1997, in der Fassung des Agrarrechtsänderungsgesetzes 2002, BGBl. I Nr. 110/2002, zugelassen sind."

At that time antagonists of the agricultural use of antibiotics thought this issue was settled at last, but promptly one year later the prohibited streptomycin was again authorized again.

Author: Did the "danger-in-delay"-exemption in Germany play a role in this concern?

Dr. Burtscher: The pressure for permission of streptomycin emanated from Vorarlberg. The Vorarlberger Fruit Growers looked with envy at their German colleagues at the other shore of the lake who were allowed to use streptomycin

Minister Pröll said to the ORF in Vorarlberg in January 2005 that he would not authorize streptomycin, but in April 2005 streptomycin was authorized to treat 19,5 ha – and because of these 19,5ha an agent forbidden at EU level had to be authorized!

Author: How is the substance streptomycin and it's health risks for humans judged?

Dr. Burtscher: Compared to other pesticides, the problem with streptomycin is not so much a problem because of the direct health reasons of farmers working with it, but for emerging resistances (against antibiotica used in medicine for humans) and the interchange of resistances.

The application of streptomycin in 2008 in Styria has been very small (only 2%-4% of the approved acreages used it)

The risk of distribution of antibiotic resistances of course rises through the use of pesticides in fruit growing with the used quantities.

That in Europe the agricultural use of antibiotics was generally forbidden was a great success in the combat against the dissemination of antibiotic resistances.

This success is carelessly jeopardized by the Austrian danger-in-delay-admission, which is considered to be a "bursting of a dam" again.

Author: What is your opinion on the economic powers acting here?

Dr. Burtscher: Amongst the fruit growers it is reported that there have been protagonists of an admission since years. But the AGES has always boasted with resisting persuasion.

The reasons leading to the about-turn might be known better by Mr. Purkharthofer. Hint: also check out press releases on www.ots.at.

On the homepage of the AGES there is an opinion of persons in the medical profession (in a medical magazine), which the AGES has posted to guard itself and demonstrate that doctors of medicine are not object the intended use of streptomycin.

Author: Have you ever been invited to submit your view by any authority?

Dr. Burtscher: No, never. Only after we had taken the initiative because of the §12(10) problems (remark by the author: description above) we have received a draft of the forbidden-agents list.

Author: What are your future visions, suggestions to find a sustainable solution?

Dr. Burtscher: The AGES continuously transports the information, that streptomycin is the only effective agent there is, which is not true. But it is forbidden! Streptomycin seems to be a tranquilizer, but other measures that will lead to containment of the infection pressure will have to be found.

Author: Is there anything else you would like to state?

Dr. Burtscher: It might be worth stating the information policy the Chamber of Agriculture 2008: on the occasion of the first application of streptomycin to pear trees the heading of the article said "No danger for apple trees" ("Keine Gefahr für Apfelbäume"). Normally you might expect the main news of an article to be contained in the header.

One of the acknowledged experts in the matter of FB is Mr. Eduard Holliger at the Forschungsanstalt Wädenswil (Projektleiter Feuerbrand; eduard.holliger@faw.admin.ch). Further Dipl.-Ing. Dr. med. Hans-Peter Hutter, from the Advisory Centres for Environmental Medicine (Institut für Umwelthygiene), University Vienna, Austria (hans-peter.hutter@univie.ac.at) might be of any help.

Author: Thank you very much for the interview!

Documents obtained at interview: none

5. [Interview Pittner]

Company/Institution: **University Vienna**, Department for Biochemistry
Interviewee, Function: Mr. Univ.-Prof. Fritz **PITTNER**, Professor for Biochemistry
Interview Location: Dr. Bohr Gasse 9 / 5th Floor / Room No. 5610, 1030 Vienna, Austria
Date and Time: 07.10.08, 10:00- 13:00
Document Status: APPROVED

Author: Please describe your educational career, to display your competence regarding the topic.

Prof. Pittner: I am a studied chemist, biochemist and physicist, (graduation "sub aucpiciis praesidentis") and have been involved in studies concerning the biosynthesis of streptomycin.

Author: How would you explain the working mechanism of streptomycin?

Prof. Pittner: Streptomycin is a bacterial antibiotic, inhibiting cell growth of susceptible bacteria.

Author: How do resistances against streptomycin occur?

Prof. Pittner: Bacteria gain the ability to generate a resistance against antibiotics in that they change their metabolisms either in degrading the antibiotics or establishing metabolic mechanisms to expel them when the antibiotics penetrate the cells.

Bacteria have the ability to interchange their acquired resistance by forwarding these to other bacteria and of course all daughter cells produced are resistant as well.

Compared to other antibiotics resistance occurs already within short time periods, which is (amongst others) a reason for the non-use in human medication.

Author: Which other reasons are there for the discontinued use of streptomycin in human medicine?

Prof. Pittner: Apart from the resistance-problem mentioned, streptomycin causes side effects such as allergies, vestibular ototoxity (nausea, vomiting, vertigo), etc. are common, further streptomycin can cause fetal harm. See [RXList 01] and [RXList 03].

Author: What happens if streptomycin is used in agriculture?

Prof. Pittner: Streptomyces species naturally occur in soil and use streptomycin to compete with other microorganisms.

But if streptomycin comes into soil in high doses because of spraying, then this can in the long run lead to massive imbalances of the composition of the microflora of the soil.

Furthermore the streptomycin resistant bacteria (the ones surviving the streptomycin-attack) can use streptomycin available (but not harmful to them anymore) as a carbon-source (energy), even pushing growth of resistant and insusceptible bacteria.

Streptomycin is water-soluble and penetrates the soil with rain. The result may be that these soils cannot be used as cropland anymore and are turned into devastated areas. It will lead to a similar situation as experienced in many regions in USA where it is already impossible to grow plants belonging to the family of rosaceous.

Because we have not scientifically observed yet, what happens, if we disturb the balance (equilibrium) in the soil, this can lead to incalculable damages: unknown damages of the ecosystem will have to be faced for sure, insecure is only the extent of the risk taken.

Author: But it is argued by the protagonists of the agricultural use of streptomycin, that its application is very limited: to be sprayed only in the blossom time and only up to three times.

Prof. Pittner: Exactly this kind of use produces resistances! If in human medication antibiotics have to be prescribed, it must be a dose to surely kill ALL the bacteria, so that no resistances build up, and you will be warned to take all the pills, and not to stop until the packet is finished, even if you feel better already.

Author: For the agriculture you have already explained the problems with occurring resistances caused by streptomycin? How high is this risk judged to impact on human health?

Prof. Pittner: Increased resistances are very bad.

Actually the antibiotic is sprayed to extinct Erwinia amylovora (bacteria causing fire blight) but it kills also all the bacteria in the surrounding in the air, soil, and with rain can reach the ground-water (remember: streptomycin is water-soluble!).

Streptomycin is normally only found in soil (e.g. in forests), where evolution has well-balanced it's existence. But if it is sprayed on blossom, leaves, branches, tree-trunks where it is not naturally belonging, there is no such a balance. Streptomycin is no reactive substance, not decomposing right away. It needs to be broken down by microorganisms. If these are not on the branches etc. it can disseminate in the environment by wind, rain etc. In water streptomycin can stay virtually forever. If we then drink water containing streptomycin, certainly the interaction on the metabolism of the human body is not the problem, but it has all the other negative impacts explained before (e.g. allergies). Additionally, by consuming water and food (e.g. honey) which have been contaminated by antibiotics and by spraying it into the environment we are breeding streptomycin-resistant bacteria so that we have no defence against them anymore. If resistant bacteria afflict us the antibiotics streptomycin will not help us anymore.

This risk is to be seen in the connection with the matter of fact that from east Europe tuberculosis bacteria, that are highly resistant against antibiotics, are moving towards our latitudes, against which our common antibiotic medication is already without effect. Furthermore in central Europe tuberculosis has no longer been inoculated anymore because it has been perceived to be extinct. This problem can lead to deaths because there is no treatment available!

Author: What about other impact on human health?

Prof. Pittner: Concerning allergies, for example, it has been known for a long time, that people having much contact with soil have a better immune-response due to actions caused by the microflora. However this triggering of the immune-system may also result in overreactions of the body: i.e. allergies.

If streptomycin is now found to be in places (drinking water, air, trees) where evolution has not been able to counterbalance its existence (as explained in the previous question) it cannot be decomposed. But also in its natural environment soil the microflora is changed due to its impact leading to imbalances.

Because of this reason streptomycin is also a strong allergen.

Author: What about the studies available for streptomycin provided for example by the AGES and the EPA?

Prof. Pittner: In the studies the "acute toxity" is described, but the LD-factor (lethal dose) does not reveal anything useful. It says that 50% of the rats die at a certain level of intake. But rats have a completely different metabolism as humans and there is no data concerning other physiological damages, as e.g. providing information on allergies induced.

Author: Regarding the CBA constructed by the author so far: are there impacts (risks) of streptomycin that the author should additionally assess in the CBA? How high are these risks judged by you?

Prof. Pittner: Again: The dangerousness of the agricultural use of streptomycin is not assessable today, because there is no binding data available.

The "hazardous substance labelling" is "unknown" for streptomycin. This does not mean that there is no danger, but on the contrary we do not know anything about them up to now. This bears a high risk!

For the calculation of the adverse effects that the agricultural use of streptomycin brings about it is probably only possible to calculate the minimum-damage (being the minimum, that has to be counted with), then explaining the nescience (lack of information) on many aspects. Only a semi-quantitative estimation of risks exposing ourselves to in the long run is possible. But it is important to note: Dealing with the streptomycin problematic one has to bear in mind that there are many synergistic parameters intercalating, many of them still unknown. The impact on human health and the agricultural problematic are always to be seen connected. Risks taken do not have additive character, but multiply!

Author: What is your consolidated opinion on the agricultural use of streptomycin (in Austria)?

Prof. Pittner: Streptomycin should not be used because of various reasons:

- Streptomycin is forbidden on EU-level – and for good reasons!
- The danger of resistances not only for humans, but also for the consequences for agriculture.
- The effect of streptomycin against fire blight is only modest, because it only reduces infections over the blossom and nothing else, not justifying such a "bomber".
- Beekeepers who are making efforts to produce high quality natural products suffer because of the agricultural use of streptomycin.
- As already pointed out in this interview the negative impact on human health is severe.

Author: What does the article [Sundin et al 1996] I have found imply?

Prof. Pittner: This is an important article you have found here. It happens from time to time that genes can "jump". This of course intensifies the problematic regarding synergies and above that shows, how hard it is to compute overflowing side-effects when interfering with the biological equilibrium. That means, whatever you can calculate here it is to be feared that reality will result to be worse, because it is not possible at the moment to capture ALL necessary parameters and moreover to quantify these. This article underlines the problems with resistances.

Author: Thank you very much for the interview!

Documents obtained at interview: [RXList 01]; [RXList 02]; [RXList 03]; [Cunliffe et al. 2006]; [Badalucco et al. 1994]; (et. al.)

6. [Interview BOV]

Company/Institution: Austrian Fruit Growers (Bundesobstbauverband, **BOV**), at the Austrian Agricultural Chamber
Interviewee, Function: Mr. DI Johann **GREIMEL**, General Executive Director Interview
Location: Schauflergasse 6/3rd floor, 1014 Vienna, Austria
Date and Time: 30.10.08, 10:00-12:00
Document Status: APPROVED

Author: The Austrian Fruit Growers (in German: Bundesobstbauverband, hereafter "BOV") is the organisation in charge for bundling interests of pome fruit growers. How has the internal decision process resulted in the demand for streptomycin?

DI Greimel: The Austrian Chambers of Agriculture are the representation bodies by law. Then there are voluntary representations, like the BOV. These are often identical in staff: I am, for example, counsellor of the Austrian Chambers of Agriculture responsible for fruit growing[755] and General Executive Director of the BOV.

DI Greimel: Orchardists are members of the Regional Fruit Growing Associations[756] in the Austrian provinces. On provincial level there are managing committees, their executive directors and chairmen taking part at the board meetings on federal level (Austrian Fruit Growers Association)[757]. Decisions taken in the board meetings are preferably aimed at achieving coordinated results.

DI Greimel: The pressure regarding the allowance of streptomycin in Austria came from the fruit growers. 2007 there had been clearances. This information gets around between the fruit growers and there was great fear of fire blight posing an existence threat and pressure on the BOV has been great to attain allowance. From the perspective of the BOV it is also judged reasonable to demand for streptomycin.

Interposed question by the Author: And regarding the decision process on streptomycin?

DI Greimel: The decision-making on the best means of pest control (for fire blight) involved a whole package of measures, also including direct measures (plant protection agents). Because streptomycin is the most effective plant protection agent, the §13-authorization[758] was needed. Laboratory tests and open land usage (e.g. in Vorarlberg) have shown this.

Practice is decisive – laboratory tests are often not transferable to practice.

Interposed question by the Author: Please state further on the other pest control measures.

DI Greimel:

- Usage of plant protection agents
- Mechanic and hygienic measures (conducted by the provincial plant protection services)
- Research (regarding genetics of resistant cultivars)
- Alternative substances (the BOV does not want to be bound to streptomycin)
- Basic testing of new plant protection agents on the market regarding their proclaimed effectiveness (costs are not covered by the BOV)
- EU-wide organization and coordination of pest control measures to mutually learn of each other. The pest control in all countries lowers the infection pressure.
- Compensation matters

[755] Remark by the author: original term used in German "Obstbaureferent der Landwirtschaftskammer"
[756] Remark by the author: original term used in German "Landesobstbauverbände"
[757] Remark by the author: original term used in German "Bundesobstbauverband"
[758] Remark by the author: danger-in-delay clause in the Austrian Plant Protection Agent Law 1997

Author: Where does the BOV retrieve its information from?

DI Greimel: From the

- AGES (trial results of comparative tests (streptomycin and other plant protection agents; Three-country-reports; research findings (on cultivar resistances)
- BMLFUW (regarding EU-level forthcomings, e.g. on the protection zone status)
- Information meetings, international symposia, technical conferences, internet

Author: Regarding the approval of agricultural use of streptomycin: how was your organization involved in the decision process (of authorizing streptomycin)?

DI Greimel: In close cooperation with the BMLFUW and AGES at the Round Tables, where all stakeholders are represented. By (direct) communication with and hearing of all parties it has been tried to balance the interests of all parties involved. The Federal Ministry decides after this hearing (ultimately bearing responsibility).

DI Greimel: Ultimately the BMLFUW decides (on the allowance of streptomycin), but strongly attends the opinion of the AGES in technical terms. In my opinion if the AGES would be strictly against it, the Federal Ministry would not oppose the AGES being the technically competent authority.

Interposed question by the Author: What about the BAES?

DI Greimel: The BAES is the technical/functional competent authority issuing the §13-authorisation for streptomycin.

The Federal Ministry is the political competent authority: because the usage of streptomycin is a thorny question having a political dimension, the BMLFUW takes over this task.

For the authorization the Federation[759] and AGES (respectively BAES) are responsible. The use of the plant protection products is matter of the provinces, but the use is only allowed after the AGES has given its permission. In 2005 and 2006 only Vorarlberg has been allowed to use streptomycin. 2008 the use of streptomycin has been allowed throughout Austria, the decision has been left up to the provinces.

Interposed question by the Author: so how could the BOV take influence on the decision process (of authorizing streptomycin)?

DI Greimel: In personal contact with the bodies.

Author: Is there a list of the Austrian full-time orchardists with the according size (value) of their orchards (and their annual crop yield)? According to which criteria (ha, etc?) and by whom is the classification of "full-time" done (thereby being qualified for streptomycin-use)?

DI Greimel: The classification is equal to the one used by "Statistik Austria"[760] in combination with a further criterion: whether the fruit grower falls into the "fruit-growing-surcharge"[761].

The author remarked, that data is not explicitly stated (but has to be calculated by deducting the organic farmers from the total) and some tables (or headers) seem to have been confused in the documents found, and hereby sends these contradictory statements to DI Greimel.

In a follow-up phone call **DI Greimel** *stated:* These calculations seem to be correct. Subtracting the organic farmers from the total number of farmers results in both IP and conventional farmers, with the IP-farmers being approximately 80%. Additional information regarding accumulative data on federal state level is not available to the BOV apart from the Statistics Austria data. In 2008 in Austria 80 farms have used streptomycin.

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[759] Remark by the author: original term used in German "Bund"

[760] Remark by the author: 0,15ha + trees planted according to a certain order; census every 5 years

[761] Remark by the author: original term used in German "Obstbau-Zuschlag"; increasing the assessed value serving as the tax base in farming

Interposed question by the Author: Why is there a fruit-growing-surcharge?

DI Greimel: Because fruit growing involves profit margins above the agricultural average.

Author: Who controls the necessity of use of streptomycin in each individual case and on which preconditions was the use allowed?

DI Greimel: there are warning systems in the provinces (consisting of several measurement stations in important regions) controlling humidity and temperature. These are operated by the fruit-growing consultancy services of the Provincial Agricultural Chambers[762] bearing the costs alone. The approval for the usage of streptomycin occurs only if the conditions (*remark by the author: for the population growth of the bacteria*) are fulfilled. The current status is published via the internet.

The use of streptomycin must be reported to the provincial governments within two days. Using streptomycin without a prior issued warning would be illegal and will be sanctioned, because it does not comply with the notice[763] issued between the AGES and the Provinces (being responsible for control and execution).

Author: Normally if a product is not listed in the IP-list (e.g. streptomycin) is used, the ÖPUL-subsidy is lost for the whole farm, but with the use of streptomycin an exemption has been made: ÖPUL-subsidy is not lost for the whole farm but only for the parts treated with streptomycin. Why is there a special regulation for the ÖPUL-subsidy concerning the use of streptomycin?

DI Greimel: It constitutes a compromise solution between the BOV and the BMLFUW. Background is that fruit growers would have been forced into illegality, because of demoralized reporting behaviour. There were reasonable fears that farmers would have used streptomycin illegally, if the subsidy would have been handled so strictly.

Interposed question by the Author: Please explain why the subsidy is so essential to the farmers.

DI Greimel: Generally this is the case for mixed agricultural holdings, where the subsidy would also have been lost for other parts of the production (mixed agriculture not only concerns fruit/non-fruit crop, but also variations within the fruit, e.g. apples and cherries). The ÖPUL-subsidy in fruit-growing is the area-related compensation payment for

- increased time and efforts (because certain plant protection agents cannot be used),
- higher production risk
- lower output (because of restricted manuring)
- higher costs for biotechnical measures
- and coherent control walks times

Interposed question by the Author: Are exemptions like this a common practice (is it frequently used with other plant protection agents, too)?

DI Greimel: No, in practice this exemption clause is not often used.

Author: Who was in charge for ordering streptomycin and at which price has it been purchased? (Costs for farmers/ha?)

DI Greimel: The respective provinces are responsible for purchasing streptomycin, on the base of the issued qualification certificates.

By the Austrian distribution partners of the Belgian producer, streptomycin has been delivered to the collection points where it is handed out (controlled).

DI Greimel: Concerning the information on the price at which streptomycin is purchased by the provinces.

Author: Are there further calculations beneficial for data input to CBA available e.g. have calculations been made regarding the necessity of the agricultural use of streptomycin on

[762] Remark by the author: original term used in German "Obstbauberatung der Landwirtschaftskammern der Länder"

[763] Remark by the author: original term used in German "Bescheid"

exemption or on the damages fire blight can cause? How are cost/risk-factors of enclosed CBA estimated by your institution?

DI Greimel: On the part of the BOV regarding the risk factors of streptomycin no calculations exist. If the substance is used according to the obligations, risk is negligible. The economic risk of a non-application is many times higher. The AGES has also reinsured itself by the expert opinion of physicians.

DI Greimel: On provincial level there are also no such risk calculations. Only calculations relating to the economic scope exist, as for example the calculation of Dr. Steinbauer from Provincial Government of Styria[764], considering the economic loss of fire blight for compensation matters.

Interposed question by the Author (on 4.11.08; answered on the 21.11.08): Is this expert opinion available by the BOV (it has not been retrievable online nor via the AGES)?

DI Greimel: I do not know, whether the BOV is allowed to pass on the expert opinion. I don't think it is open for public. Moreover it is now outdated, because residues have been found in apples and it has to be regenerated.

Author: Is there a summary on how high the fire blight infection pressure and coherent losses due to fire blight have been in Austria in the last years? Are there maps showing the spreading of infection?

DI Greimel: Not at the BOV. But the AGES is currently working on a strategy paper (probably finished by the end of this year) and also has to issue national reports[765] to the BMLFUW (being the principal and the responsible institution) which are necessary for reporting to the EU (monitorings). In these yearly report statements on the appearance of fire blight in Austria (in the respective year) can be found (but not visualized, just written).

Author: Is there a list on how much streptomycin has been used in the last years in Austria?

DI Greimel: The report, which I have just mentioned before, that is issued by the AGES at the end of the year, includes all these details on who, when, where, has used which quantities of streptomycin – constituting an obligation of the notice allowing the limited use of streptomycin in Austria.

But information could also be obtained at the responsible regional offices (of the provincial governments): For example for 2005 and 2006, when the use was only allowed in Vorarlberg, the Chamber of Agriculture Vorarlberg could be contacted, to provide exact data. But it has not been much, since the pomiculture of Vorarlberg does not carry much weight regarding Austria's fruit growing in total.

Author: Which information is forwarded by your organization to qualified applicants regarding the use of streptomycin?

DI Greimel: The BOV is responsible for strategic and political questions. In the provinces the regional fruit growers associations[766] and the regional economic chambers together perform the consulting service of the fruit growers arranging information events, operations consulting, trainings and technical events in winter.

Author: Which measures against fire blight are recommended by the BOV on the one hand for full-time orchardists and on the other hand to organic farmers?

DI Greimel: There is no difference between organic farming and IP except for the use of streptomycin and the shifted stress to mechanic measures. Although there is a plant protection agent for organic farmers, Blossom Protect, it is not so effective according to the current state of knowledge and streptomycin is still the most effective substance.

Author: Are farmers compensated when affected by fire blight? (if yes: to which extent, by whom) Is there an insurance against the risks of fire blight losses?

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[764] Remark by the author: these calculations have been forwarded to the author: [Steinbauer 2008])

[765] Remark by the author: in contrast to the "three-country" reports (of Germany, Switzerland, Austria)

[766] Remark by the author: original term used in German "Landesobstbauverbände"

DI Greimel: Compensation payments are different in the individual provinces, because it is a provincial matter. In Vorarlberg (approximately) 80%[767] are compensated, in Styria only (approximately) 30-40%. The differing intensity of fruit-growers and the coherent importance of fruit-growing in the respective province explains this difference (for example Styria cannot pay as much as Vorarlberg to all of it's many fruit growers). There is no insurance against the risks of fire blight losses.

Interposed question by the author: is it assumable that compensation will be harmonized across Austria someday (would it not be a solution to regulate this issue nationwide)?

DI Greimel: No, the plant protection agent usage and the compensation payments will stay province matter.

Author: Regarding the further outlook: Is the agricultural use of streptomycin based on §13 also planned in future? How many times can the §13 be used?

DI Greimel: As far as I know there is no limitation (to the usage of the danger in delay clause).

As soon as there is another plant protection product available, that can replace streptomycin, it will not be needed anymore. But as long as there is none, the BOV will adhere to its demand for the usage of streptomycin. In my opinion, it will not be that another substance is as effective as streptomycin in the short-run.

Author: Is there anything you would like to remark additionally?

DI Greimel: No, I thing the most important facts have been addressed.

Author: Thank you very much for the interview!

Documents sent by the author: CBAv1.1.xls

Documents handed over by the interviewee: none

Further agreements: A copy of the case study will be submitted after completion.

7. [Interview AGES 02]

Company/Institution: Austrian Agency for Health and Food Safety (**AGES**), Institute for the Evaluation & Authorization of Plant Protection Products
Interviewee(s)/Function(s): Hofrat Robert **Womastek**
Interview Location: Spargelfeldstrasse 191, 1220 Vienna, Austria
Date and Time: no response to despite the author's many efforts
Document Status: **The author was ignored, the interview could not be held**

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1. Decision process regarding the approval of agricultural use of streptomycin

1.a. *Please describe the process of approval and the reasons for approval of streptomycin although banned in EU and Austrian law: Which persons from which institutions/authorities in what order were involved in the decision process? Please state the legal framework regulating this decision process.*

1.b. *Document request for the official approval of plant protection agents regarding to exemption §13 PSMG in Austria (and on EU-level according to Art. 8(4) of 91/414 EEC) published?*

[767] Calculations on the base e.g. provided by Dr. Steinbauer; Remark by the author: see [Steinbauer 2008]

1.c. *What is the role of the AGES exactly regarding this approval of streptomycin and in what way is the AGES being subject to directives?*

1.d. *Were NGO's involved in the decision process? Which ones?*

2. Pressure of which players influenced the decision process?

2.a. *Was the approval in Germany a lever?*

2.b. *What did the BOV and the LKÖ want?*

2.c. *Is it correct, that normally, if a product not listed in the IP-list is used, the ÖPUL-subsidy is lost for the <u>whole</u> farm?*

2.d *And is it correct, that with the use of streptomycin an exemption has been made: ÖPUL-subsidy is not lost for the whole farm but only for the parts treated with streptomycin? (additional costs to be implemented in CBA)*

3. Procedure regarding applications for agricultural use of streptomycin:

3.a. *Classification of qualified applicants according to which criteria (ha?) and by whom? Does the AGES have a list of the Austrian full-time orchardists with the according value of their orchards, and (in comparison) other orchardists (no. + value)?*

3.b. *Which information is forwarded to qualified applicants regarding the use of streptomycin?*

3.c. *Procedure of ordering streptomycin by applicants?*

3.d. *Who controls the necessity of use of streptomycin in each individual case and on which preconditions was the use allowed? (e.g. Mary Blight-System)*

4. Cost-Benefit-Analysis (CBA):

4.a. *Availability of calculations beneficial for data input to CBA (e.g. have calculations been made regarding the necessity of agricultural use of streptomycin on exemption?)*

4.b. *Is there a summary (pooled information) on how much fire blight infection pressure (losses due to fire blight) of the last years in Austria?*

4.c. *Is there a summary (pooled information) on how much streptomycin has been used in the last years in Austria?*

4.d. *How are cost/risk-factors of <u>enclosed CBA</u> estimated by your institution?*

4.e. *Are there any additional factors to be included?*

5. General information:

5.a. *Which measures against fire blight are recommended by the AGES and why?*

- for full-time orchadists
- for organic farmers, scattered fruit trees, trees in private gardens?

5.b. *Are farmers compensated when affected by fire blight? (if yes: to which extent, by whom)*

Is there an assurance against the risks of fire blight losses?

5.c. *Outlook: Is the agricultural use of streptomycin based on §13 also planned in future? How many times can the §13 be used?*

5.d. *How is the development of alternatives supported by the state? E.g. tax reductions, research subsidies, admission to Annex I of EC 91/414*

6. *Additional Remarks:*

Are there any additional remarks, you would like to state from your side?

Documents attached by the Author: CBAv 1.1.xls

8. [Interview ÖIB]

Company/Institution: Austrian Beekeepers Association ("Österreichischer Imkerbund" (**ÖIB**))
Interviewee(s)/Function(s): Mr. Josef **ULZ** (President)
Interview Location: via Telephone Calls
Date and Time: 08.11.08, 09:25 – 09:40 and 10:30-10:40 and 13:00-14:45
Document Status: APPROVED

Author: What is the economic value of bee-keeping regarding honey(products) and pollination?

Ulz: The honey production each year is approximately 5 million kg. This is a long-term average (10-year-average) with production values between 3,5 – 7 million kg.

The kg honey is worth 7,50€/kg (on average).

Pollination work of the bees can be estimated to be approximately a ten-fold of this value *[Remark by the author: 7.5€/kg * 5 million kg= 37.5 million€*10= 375 million€]*

This does not include the pollination work on wild [*Remark by the aut*hor: non-cultivated] plants, which has to be seen delivering an additional value, but is very hard to measure.

In America calculations have assumed the value to be the 135-fold – but there are other preconditions: agriculture is structured differently with big areas, that are more dependant on pollination by bees.

In Austria there are two associations:

- the Austrian Beekeeper Association (Imkerbund (ÖIB)) and the
- Austrian Full-time Beekeeper Association (Erwerbsimkerbund (ÖEIB)).

Within the IB there are 22500 members and within the EIB 252.

The IB officially has 291.000 bee-hives, the EIB 35.000.[768]

Because the membership fee for the associations is dependent on the number of bee-hives, these official values are not the real ones. (Beekeepers tend to forget to report

[768] The number of bees within a hive varies depending on the time of the year (season) starting in spring with 10-11.000 bees growing up to 35-40.000 in summer.

some bee-hives in order to lower their fees). In reality there is an estimated quantity of 450.000 bee-hives in Austria.

Author: In which costs are entailed by the agricultural usage of streptomycin for the beekeepers (image-loss, sales losses, disposal fees, laboratory analysis, bee-hive moving, etc)?

Ulz: The problem was that in media it was communicated that there was a possible antibiotic contamination of honey, that it even would have to be discarded, by which the customers were rattled that they would maybe consume honey with streptomycin residues.

Although the quantity we are speaking of is extremely low: The beekeepers have chosen a so-called zero-tolerance: everything above the detection limit of 5µg/kg is discarded.

To draw comparisons which other residue levels exist: Meat: 500 µg/kg; Milk: 300µkg (/kg?); Intestines: 1000µg/kg.

The average consummation of meat/year is about 90-110 kg, honey only 1,5 kg/year.

But the costumer sees this differentiated: hears "residues" and is scared of hazardousness to health. Above that with honey the customer takes it for granted that there is nothing allowed to be in the honey. With other products there may be a lack of knowledge, or it is simply tolerated out of the fact, that it is accepted because there is no will to quit on eating meat (for example). With honey the expectations are different. This is why the beekeepers have decided for the zero-tolerance, although it is daring, because the accuracy of analysis methods develops and the detection limit (at the moment 5µg/kg) will lower. Exaggerating it could be said, that if this would be done with all food stuff virtually no food stuff could be eaten anymore, if there are no residues tolerated. That is why it is important to install residue limits, which is set at 10µg by the EU. The Austrian beekeepers are even stricter. Also the food retailers are very strict and test the honey themselves: products containing antibiotic[769], will be resent to the producer.

Experiences have shown that residues are practically never higher than 20µg/kg and the beekeepers have been asked why they are so strict by the fruit growers (who would not have the problem with the beekeepers with higher limits) and the provincial governments (who would not need to pay). But the beekeepers have tried to argue, that the customer generally reacts very vehement on "residues" if these are µg or mg is not of interest – (s)he hears "residues" and rather chooses to eat jam, if one has to suppose that there are unwanted contents in the honey. It can be observed from the reactions of our customers that honey seems to have a relative importance/respect from remarks like "now you can't even eat honey anymore". It shows that in the customer view honey is a natural product. Residues might be accepted in other food stuffs, but not with honey. The fruit growers have after the public discussion, the withdrawal of the AMA-label and the supermarket's resistance to sell fruit from areas where streptomycin has been used, experienced this year how the sensitive the market can react even if residues on the fruit are not the topic. The customer cannot bother to judge about residuals - he wants to know: are the apples sprayed or not sprayed? Also the fruit growers will not be able to endure such reactions each year.

Mankind has become more attentive and sensitive, however public by itself is powerless, because policy has the power to rule - but public discussion can have a corrective impact: when public discussion arose on streptomycin and the supermarkets and the AMA reacted correspondingly, that took effect - because if the product cannot be sold anymore, then it hurts.

The image costs and sales losses of the beekeepers are hard to estimate.

Consumer behaviour often calms down again after the first shock. The effect seems to be rather short-termed. There are no reports from the beekeepers, only discussions on the

[769] Regardless whether within the allowed interval 5-10µg/kg or above that.

experiences of customer reactions. Very probably the issue will be forgotten by the customers until Christmas (which is the time with the highest sales in the honey-business).

In the end impact on customer reaction as a whole is estimated to be rather low at the moment [in the short term].

What defused the situation a little, so that customers would not have to be worried about residues, was the Austria-wide honey monitoring everywhere, where there has been sprayed. The AGES has elaborated a security concept, determining where samples would have to be taken to see whether there is a risk.

In Styria there are more than 2000 full-time-orchardists (which were entitled to use streptomycin), but only 170 farmers really used it this year (due to the weather conditions). The EU at the moment allows for 10µg/kg residues of streptomycin in honey. It has been tested for the detection limit of 5µg/kg. 110 samples have been under the detection limit, only one sample has been above the detection limit of 6µg. This sample has been drawn from a rather small beekeeper, who has stated, that he will not sell the honey anyway (because of his small production volume) and he himself and his family/friends will eat the honey. Otherwise it would have been disposed by the Styrian Province.

The beekeepers are not pleased. We don't want to produce to then dispose the honey, also if the honey is purchased (compensated). We are against the agricultural use of streptomycin and hope it will soon not be needed anymore. In the long run (e.g. the next ten years) we will not have the staying power to stand the loss of customer trust and sales: if every year there is a discussion in media on the use of streptomycin and every year the customer is made insecure again - this is not sustainable. The beekeepers have their backs to the wall.

But it was politically decided and not preventable.

The minister [*Remark by the author: of the BMLFUW*] of course had to weigh up the economic impacts of the big group of farmers (2400 full-time-orchardists) against the relatively small group of beekeepers (in Styria e.g. there are only 40 full-time-beekeepers). Anyways it should not be that the beekeepers don't care about the orchardists going bankrupt. But we also had to fight for the understanding that a solution cannot be achieved by setting the residue limit up to 30µg (as suggested) because (as explained before) then there would be practically no honey above the residue limit. In my opinion it was underestimated, that beekeepers would refuse such a solution (but the reasons why have been made clear).

2008 no honey had to be disposed, which was quite surprising: in Switzerland there were contaminations. Maybe it has helped, that in the intensive negotiations where all concerned parties are bound in, we have demanded the BOV to ensure that the sprayings only take place at night times, where there are no bees flying. Whether or not the farmers have kept to it or not, cannot be proofed.

Author: What about the compensation payments, who pays, under which circumstances and how much?

Ulz: Compensation payments are always provincial matter and must be negotiated with the provinces, because fire blight is provincial matter. For Styria (being the most concerned area) the monitoring-concept has been drawn up by the beekeepers association (together by the AGES) and could be used by other provinces as a base.

Author: What is your view on the procedures in the decision process on the agricultural use of streptomycin?

Ulz: There are Round Tables with the AGES involving all concerned parties (orchardists, tree nurseries, beekeepers, provincial governments, …). The information passing on the agricultural use of streptomycin has worked similar to military precision[770] and exemplary.

A useable solution was needed, that can be sustained by everyone. The beekeepers have made their point of view clear - but for political and economic reasons streptomycin was accepted to be necessary. The beekeepers have therefore set the precondition that:

- A) data of all beehives concerned was collected
- B) and that there is a monitoring where it is sprayed. The data on when and who has sprayed have been made public in the internet by a map open to everyone. *[Remark by the author: asked for the address the URL Mr. Ulz has assumed that it should be found by the catchwords "Feuerbrand, Bekämpfung, Steiermark" found to be* http://www.agrar.steiermark.at/cms/beitrag/10885917/13082183/*]*

This way beekeepers had the possibility to know whether streptomycin has been sprayed in his area. Sprayed areas were included in the monitoring, if the beekeeper was part of the sample taking program, the sample was taken.

In Styria money was also secured for the worst case scenario: if all orchardists that could have sprayed and the whole honey would have to be disposed: 1 million Euro was set aside for this worst case.

Author: What has been communicated about existing alternatives e.g. Blossom Protect?

Ulz: I am not an expert; I am only stating what I have heard from the AGES and the fruit growing research centers (e.g. Haidegg in Styria). Two disadvantages have been mentioned in the discussions at the Round Tables:

- In outdoor test there are not the same results as in glasshouse (the efficiency is worse)
- The product results in fruit-russeting.

It has always been stated that there is no such efficient product as Plantomycin *[Remark by the author: streptomycin-product].*

In summer this year [*Remark by the author: 2008]* the results of efficiency tests claimed by the producers of BP were not identical with the ones found out by the AGES and research centres of Vorarlberg and Styria (Haidegg). There have been discussions on whether the efficiency test results from the company selling Blossom Protect have been "massaged" or whether the trial centres have done something wrong. As a solution it has been agreed, that a member of the company will join and watch the trials in future.

I (as layman) cannot judge who is right, but of course there is the need to let research be objective, not influenced by the interests of groups. The AGES, being independent of sponsors can be neutral and objective in this situation. In my subjective opinion I have the impression that it is tried to get away from streptomycin. The AGES is now working on a strategy paper, so that not every year again we have to start from the scratch, but giving a perspective on how FB shall be controlled the next years, the main task being to find alternatives to get away from streptomycin. The provinces shall bring in proposals, than there will be discussions on the discrepancies with all participants, finding solutions acceptable for all. Nobody is happy with streptomycin and it is a shared opinion, that we have to get away from the streptomycin use, but there is disaccord on the way how.

What has shocked me has been a conference on the alternatives measures against fire blight that has been attended by me and fruit growers around the 10./11. December 2007 in Dossenheim (BBA) where it has been presented how far research has come regarding

[770] Originally term used in German: "generalsstabmässig"

alternatives: a known German medic (some honoured President of the Medical Association) has held a talk on the impacts of streptomycin in the environment, the bottom line being that from the viewpoint of human medicine there are no worries regarding the use of streptomycin in the environment. He has reasoned very scientifically, so that I have actually not understood, why exactly there are no effects, but also nobody opposed him. He has conveyed the impression that there is no problem at all from the environmental side, which in fact is against what the issue suggested always to me. Actually the question arose inside me, whether this man was "bought". If he would have also said, there is much that we don't know, but so it sounded more like a dogma to me…

This is the problem: science has not delivered clear messages and the experts have still not come to an agreement. How shall a layman then know what is right?

When the fire blight problem turned up and we (beekeepers) noticed, that we were right in the middle, we have tried to find alternatives on our own. If bees fly to orchards (also possibly causing the dispersion of FB) they could also help to control FB and not only in intensive orchards. In New Zealand there were already trials with yeast products, with which the bees would be covered, taking the substance to the plants. Unfortunately there was disillusionment: apples showed fruit-russeting and the efficiency was not as good as observed in New Zealand. The bees cannot be steered and therefore the high efforts did not pay off.

According to experts it takes time until 2011/12 to be able to do without antibiotics. This is because for example the growing of FB-resistant plants is a longsome matter (developing, planting until apples are available). Up to now there is no radical success, but of course this can change in future. This is why the beekeepers require the stress on research (research program) because otherwise in 10 years we will still be put off.

In South Tyrol antibiotics are generally forbidden to use in the environment. Being the typical fruit-growing-province it has in comparison only suffered little losses due to FB: If there is FB it is rigorous cleared. Further in South Tyrol it has been politically feasible, that all host plant have been cleared, maybe because the region depends so much on orcharding that it was accepted. So the infection pressure could be lowered in general for the orchards. In Austria it has also been tried but the resistance of private garden owners has been very high, they were not willing to clear existing plants in their garden (not feeling concerned with FB), therefore there are only recommendations and there is the law prohibiting further spreading of host plants like e.g. cotoneaster – it would be a punishable offence to sell such a plant in a tree nursery, market. It is also not feasible to compensate, payments would be too high. Therefore in Austria streptomycin seems to be the lesser of the two evils. The orchardist only sprays because he has a problem, after all: the agent is expensive and the ÖPUL subsidy is lost, resulting in high costs. But on the other hand the orchardists also have to put themselves in our position! Also for private neighbouring gardens it is actually also unacceptable that they have to tolerate sprayings of antibiotics next to them.

The Austrian food-retailers have an alternative because apples from untreated orchards of South Tyrol where Streptomycin is forbidden to use are available. If every country would use antibiotics there would be no chance anyway, but this way the retailers can choose…

Author: Thank you very much for the interview!

Further Remarks: The telephone call was held in German language. Despite all the inputs acquainted during this very interesting and extensive discussion held on the phone, not all inputs could be transformed into a minutes of meeting, since this would have gone far beyond the scope of this paper and would deliver inputs for another case study. Nevertheless the author has tried to translate the most important statements.

9. [Survey on Food Retailers]

From: diewinklers@hotmail.com
To: office@spar.at; office@merkur.co.at; hotlinebilla@billa.co.at; office@unimarkt.at; hotline@lidl.at; kundenservice@adeg.at; servicecenter@penny.at; kundenservice@zielpunkt.at
Subject: Streptomycin-Fallstudie an der Uni-Wien
Date: Wed, 8 Oct 2008 14:39:47 +0200

Sehr geehrte Damen und Herren!
Im Rahmen meiner Diplomarbeit zur Erlangung des akademischen Grades Mag. rer. soc. oec a der Universität Wien (Lehrstuhl für Industrie, Energie und Umwelt, Prof. Wirl, Betreuer: DDr. Noll) verfasse ich eine Fallstudie über den Einsatz von Streptomycin in der Landwirtschaft und erstelle dabei eine Kosten-Nutzen-Rechnung. Dabei werde ich auch den (angedrohten)Handelsboykott des Lebensmitteleinzelhandels bewerten und möchte diesbezüglich auch nachfragen, wie diese Causa nun letzten Endes gehandhabt wurde/wird.
Bitte beantworten Sie untenstehende Fragen, damit ich meine Kalkulation abschliessen kann.
1. Verkaufen Sie nun Äpfel von streptomycinbehandelten Flächen?
Wenn Antwort = Nein:
2. Aus welchen Gründen/Überlegungen heraus haben Sie das angedrohte Boykott wahr gemacht?
Wenn Antwort = Ja:
3.a. Wenn ja, wieviel? (Prozent des gesamten Apfelsortiments)
3.b. Tragen diese dennoch das AMA-Gütesiegel?
3.c. Sind diese sonst durch irgendwelche Kennzeichnung von anderen (nicht streptomycin-behandelten) unterscheidbar?
3.d. Aus welchen Gründen/Überlegungen heraus haben Sie das angedrohte Boykott nun nicht wahr gemacht?
4. Sonstige Angaben, die Sie gerne angeben würden?
Ihre Antworten werden, mit Ihrem Einverständnis, in voller Länge im Annex der Diplomarbeit veröffentlicht.
Vielen Dank für Ihre Mühe!
MfG,
Simona Winkler
Linzerstr. 14
4490 St. Florian
0660-4025090
Schreiben ergeht an: Spar, Merkur, Billa, Unimarkt, Lidl, Hofer, Penny, Adeg, Plus (Zielpunkt)

1) [SPAR] – original response

E-Mail am 15. January 2009

SPAR-Info

Liebe Frau Winkler!

Vielen Dank für Ihr Interesse an unserem Unternehmen.

Hier die Antworten (siehe kursive Schrift) auf Ihre Fragen:

1. Verkaufen Sie nun Äpfel von streptomycinbehandelten Flächen?

Nein. Man muss aber unbedingt wissen, dass Streptomycin heuer kaum eine Rolle gespielt hat: Es wurden heuer lediglich 2 Prozent aller Äpfel-Anbauflächen mit Streptomycin

behandelt. Wir haben daher überhaupt keine Probleme gehabt, die von uns benötigte Menge an unbehandelten Äpfeln von den Lieferanten zu bekommen.

Wenn Antwort = Nein:

2. Aus welchen Gründen/Überlegungen heraus haben Sie das angedrohte Boykott

wahr gemacht?

Antibiotika haben unserer Meinung nach bei der Lebensmittel-Produktion nichts verloren. Auch wenn sie auf den Früchten nicht mehr nachweisbar sind, haben sie doch größere ökologische Folgen (Boden, Resistenzen, ..). Ein zweiter Grund: Wir wissen, dass unsere Kundinnen keine Äpfel in den Regalen haben wollen, die mit Medikamenten behandelt worden sind.

Wenn Antwort = Ja:

3.a. Wenn ja, wieviel? (Prozent des gesamten Apfelsortiments)

3.b. Tragen diese dennoch das AMA-Gütesiegel?

3.c. Sind diese sonst durch irgendwelche Kennzeichnung von anderen (nicht

streptomycin-behandelten) unterscheidbar?

3.d. Aus welchen Gründen/Überlegungen heraus haben Sie das angedrohte Boykott

nun nicht wahr gemacht?

4. Sonstige Angaben, die Sie gerne angeben würden?

Das Thema „Stryptomycin bei Äpfeln" ist für uns ein Thema, das sehr viel weitreichender ist: Es geht auch darum, die Landwirtschaft zum Nachdenken zu bringen – die machen es sich manchmal zu einfach (indem sie nicht im Sinne der Konsumenten handeln). Außerdem: Es muss auch ein staatliches Entschädigungssystem geben für betroffene Bauern.

Frau Winkler, wir hoffen, Ihnen mit diesen Infos weitergeholfen zu haben und wünschen Ihnen viel Erfolg für Ihre Fallstudie!

Freundliche Grüße aus Salzburg

Mag. Verena Wegscheider

PR & Information

2) [REWE] – original response (BILLA, MERKUR, PENNY)

Subject: Streptomycin-Fallstudie an der Uni-Wien

Date: Wed, 8 Oct 2008 15:46:23 +0200

From: C.Tinkler@rewe-group.at

To: diewinklers@hotmail.com

CC: H.Fleischhacker@merkur.co.at; T.Englisch@rewe-group.at; K.Nakhai@rewe-group.at

Sehr geehrte Frau Winkler,

sehr gerne informieren wir Sie seitens REWE Group Austria über den Verkauf von Äpfel streptomycinbehandelter Flächen. Sollten Sie darüber hinaus Fragen haben, würde ich Sie bitten mit der AMA beziehungsweise auch mit der AGES (Österreichische Agentur für Gesundheit und Ernährungssicherheit) Kontakt aufzunehmen.

Mit freundlichen Grüßen,

Corinna Tinkler

☐ 2008 wurden aufgrund der günstigen Witterung nur zirka 2% der heimischen Kernobstflächen (inkl. Junganlagen) zum Schutz gegen den Feuerbrand mit dem Wirkstoff Streptomycin ausschließlich während der Blüte behandelt.

☐ Da im Jahr 2008 der Einsatz von Streptomycin in Österreich so gering war, ist es für diese Vermarktungssaison (2008/2009) möglich, nur jene Äpfel über den Lebensmitteleinzelhandel zu vermarkten, die von Kulturen stammen, welche NICHT mit Streptomycin behandelt wurden.

☐ Ein zusätzliches von der AMA Marketing beauftragtes Rückstandsmonitoring nach neuesten Untersuchungsmethoden bzw. Nachweisgrenzen ergab, dass in den Früchten keine Rückstände nachweisbar sind. Weiters konnten in allen bis dato über 180 untersuchten Honigproben keine Rückstände von Streptomycin nachgewiesen werden.

☐ Um den naturnahen Kernobstbau in Österreich in Zukunft aufrecht zu erhalten bzw. abzusichern, ist es notwendig, die Forschung zur Bekämpfung von Feuerbrand weiter zu intensivieren und geeignete Maßnahmen zu setzen. Zu diesem Zweck wird von der AGES unter Einbeziehung der Fachöffentlichkeit eine "ganzheitliche Strategie zur Feuerbrandbekämpfung 2008-2013" ausgearbeitet und einer jährlichen wissenschaftlichen Evaluierung unterzogen.

Mag. Corinna Tinkler

REWE GROUP Austria

Pressesprecherin

Leiterin Unternehmenskommunikation

REWE Austria AG

Industriezentrum NÖ-Süd, Straße 3, Objekt 16

A-2355 Wiener Neudorf

Firmenbuch: LG Wr. Neustadt, FN 82769w

Tel.: +43 2236 600-5262

E-Mail: c.tinkler@rewe-group.at

3) [Zielpunkt] – original response

To: diewinklers@hotmail.com

Subject: WG: Streptomycin-Fallstudie an der Uni-Wien

From: baigner@zielpunkt.at

Date: Thu, 23 Oct 2008 13:45:41 +0200

Sehr geehrte Frau Winkler,

vielen Dank für Ihr Email vom 08. Oktober, in dem Sie Fragen zum o.g. Thema stellen.

Aufgrund konzerninterner Richtlinien können wir uns der Fallstudie nicht beteiligen.

Vielen Dank für Ihr Interesse an der Marke Zielpunkt.

Mit freundlichen Grüßen

Bettina Aigner

Abteilung Marketing

ZIELPUNKT WARENHANDEL GmbH & Co KG

A-1239 Wien, Heizwerkstraße 5

www.zielpunkt.at

Tel.: +43/1 / 610 45/ 293

Fax.: +43/1 / 610 45/ 280

4) [Telephone Call Hofer]

Company/Institution: **Hofer KG**, Stockerau, Management
Interviewee: Interviewee wants to stay **anonymous**, for corporate strategy reasons
Date and Time: 10.10.08, 13:50-14:03
Document Status: APPROVED

Interviewee: No apples will be retailed from streptomycin-sprayed areas in Austria.

Nevertheless Hofer would have been willing to sell apples from streptomycin-treated areas in Austria, demanding that residues of streptomycin would not be found on the apples or would be below measurability of scientific proof of the residuals.

Apples from streptomycin sprayed areas are not sold because of two major reasons:

The weather conditions have been good this year, so that only 2% of the areas have actually been treated with streptomycin.

The farmer representatives *(who exactly was not known by the interviewee)* have decided to export these apples, so that no apples from treated areas in Austria are on the market this season. This decision is assumed to be taken partly because of the considerations and the reservations (of possible negative impacts on animal, human and health) other food retailers have declared.

There have meetings at the AMA with some representatives of the retailers and sometimes also farmer representatives.

From the AGES, Dr. **Girsch** has presented a Powerpoint slide-show, informing on streptomycin. The main information transported was that streptomycin was used internationally, except in South Tyrol, and that streptomycin was "harmless"[771].

But as explained before Hofer would have been willing *[remark by the author to retail apples from treated areas]* and had a practical attitude towards the issue: if the apples did not contain streptomycin, then the treatment would be irrelevant.

Author: Thank you for time and the information shared!

[771] Remark by the author: German orgininal "unbedenklich"

ANNEX II to the Case Study: Further Communication

A) EFSA

From: Simona Winkler [mailto:diewinklers@hotmail.com]
Sent: 21 July 2008 22:52
To: info@efsa.europa.eu
Subject: Data request for thesis
Dear ladies and gentlemen,
since I have not attained any entries for the search on "streptomycin" nor "fire blight" nor "Erwinia amylovora" but on your hp you state to be "the keystone of European Union (EU) risk assessment regarding food and feed safety" [...] and that your organization" provides independent scientific advice and clear communication on existing and emerging risks" I would like to kindly ask you, if there is any risk assessment on the use of streptomycin against the plant disease fire blight in the EU.
Your input would be highly appreciated because I am writing a thesis at the University of Vienna, (Institute for Industry, Energy and Environment) treating this topic in a case study.
Best regards,
Simona Winkler
Subject: Streptomycin
Date: Mon, 4 Aug 2008 18:22:38 +0200
From: Juergen.STURMA@efsa.europa.eu
To: diewinklers@hotmail.com
CC: Lara.CONGIU@efsa.europa.eu; Jane.BARLING@efsa.europa.eu; Ragnor.PEDERSEN@efsa.europa.eu; Tunde.MOLNAR@efsa.europa.eu
Dear Ms Winkler,
the active substance streptomycin is part of the so called 3rd stage of the review programme for existing active substances and therefore the evaluation would fall under EFSA's responsibility. Nevertheless this substances has never been evaluated, because it was not included in Annex I of the Council Directive 91/414(EEC). The related decison, which is also available on the internet, is attached to this message.
Unfortunately within EFSA there is no additional information avialble.
Best regards
Jürgen Sturma
****
Jürgen Sturma
Scientific Co-ordinator
European Food Safety Authority
Pesticide Risk Assessment Peer Review (PRAPeR)
Largo N. Palli 5/A
I-43100 Parma
Tel: +39 0521 036 655
Fax: +39 0521 036 0 655
Email: juergen.sturma@efsa.europa.eu
Website: http://www.efsa.europa.eu
Subject: FW: Data request for thesis
Date: Mon, 18 Aug 2008 11:46:53 +0200
From: Elzbieta.CEGLARSKA@efsa.europa.eu
To: diewinklers@hotmail.com
Dear Simona,
Confirming what my colleague has already informed you about, namely that the EFSA Panel on Plant Health has not dealt with the issue you are interested in, I would like to call you attention to a recently published opinion by the Panel on Biological Hazards on "Food borne antimicrobial resistance as a biological hazard", along with the comments received during the public consultation, on EFSA's website:
http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1211902034881.htm
Kindest regards

****
Elzbieta Barbara Ceglarska
HoU, Scientific Co-ordinator
Panel on Plant Health
European Food Safety Authority
Largo N. Palli 5/A
I-43100 Parma
Italy
Tel.: +39 0521 036 476
Fax: +39 0521 036 0476
E-mail: elzbieta.ceglarska@efsa.europa.eu
http://www.efsa.europa.eu/EFSA/ScientificPanels/efsa_locale-1178620753812_PLH.htm

B) WWF - NO RESPONSE

From: diewinklers@hotmail.com
To: fp@wwf.at
Subject: Streptomycin Fallstudie an der Uni Wien
Date: Tue, 15 Jul 2008 09:31:24 +0200

C) WHO - NO RESPONSE

From: diewinklers@hotmail.com
To: info@who.int
Subject: Case Study at the University of Vienna: Streptomycin
Date: Tue, 15 Jul 2008 14:32:00 +0200

From: diewinklers@hotmail.com
To: info@who.int
Subject: Urgent Request: Case Study at the University of Vienna - "Agricultural use of Streptomycine"
Date: Wed, 13 Aug 2008 11:12:40 +0200

From: diewinklers@hotmail.com
To: aidarakanea@who.int
Subject: Streptomycin
Date: Fri, 3 Oct 2008 08:55:09 +0200

D) EPA

From: diewinklers@hotmail.com
To: wormell.lance@epa.gov
Subject: Case Study at the University of Vienna - "Agricultural use of Streptomycine"
Date: Wed, 13 Aug 2008 13:13:13 +0200
Dear Mr. Lance Wormell,
for the completion of my thesis at the University of Vienna (Austria) on the topic "Interactions of Environmental Law and Economic Power" I am writing a case study (creating a cost-benefit-analysis) on the approval of Streptomycin for agricultural use against fire-blight, although European (common) and national (Austrian) law had already banned it. For a detailed and comprehensive representation of the issue I would like to incorporate many viewpoints regarding the use of this antibiotic in farming.
As I have just browsed through the EPA's articles on Streptomycin I have not found, whether any (more recent) risk assessment(s) (calculations) exist apart from EPA-HQ-OPP-2005-0493-0025. Your input would be very much appreciated!
Thank you very much for your efforts!

Best regards,
Simona Winkler

Subject: Re: Case Study at the University of Vienna - "Agricultural use of Streptomycine"
To: diewinklers@hotmail.com
From: Wormell.Lance@epamail.epa.gov
Date: Wed, 13 Aug 2008 10:54:46 -0400
Simona,
The most recent EPA Office of Pesticide Programs assessments are
available in the public docket at regulations.gov:
http://www.regulations.gov/fdmspublic/component/main?main=DocketDetail&d=EPA-HQ-OPP-2005-0493.
In addition to the tolerance reassessment decision you referenced below, you may find the human health assessment useful in your review:
http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&d=EPA-HQ-OPP-2005-0493-0011.
Feel free to contact me with additional questions. Best of luck completing your thesis.
Lance Wormell
U.S. Environmental Protection Agency
Office of Pesticide Programs
Wormell.Lance@epa.gov
(703) 603-0523

E) BMLFUW

Sehr geehrter Herr Lukas Weber-Hajszan!
Wie aus untenstehendem Mail ersichtlich, bin ich von Herrn DI Martin Gessl an Sie verwiesen worden.
Im Rahmen meiner Diplomarbeit "Wechselwirkungen zwischen Umweltrecht und Wirtschaft" an der Universität Wien (Institut für Energie, Industrie und Umwelt) verfasse ich eine Fallstudie über den Einsatz von Streptomycin in der Landwirtschaft inklusive einer Kosten-Nutzen-Rechnung.
Für die Kalkulation brauche ich verschiedenste Daten. Unter anderem muss ich auch eine etwaige Ausnahmeregelung der ÖPUL-Förderung in Bezug auf den Streptomycin-Einsatz gegen den Feuerbrand miteinrechnen. Könnten Sie mir bitte genauere Angaben zu dieser Regelung und die Gründe für diese Ausnahme mitteilen?
Ausserdem wird in der Fallstudie der Ablauf (Prozess) der Ausnahmeregelung für Streptomycin dargestellt. Ich habe diesbezüglich mit der AGES bereits Kontakt aufgenommen und bereits mit dem Institut für Pflanzengesundheit gesprochen und werde noch einen weiteren Termin mit den Institut für Pflanzenschutzmittelbewertung und -zulassung wahrnehmen dürfen.
Wie auch unten angeführt hat das BAES die Zulassung von Streptomycin veranlasst. Welche Rolle hat das BMLFUW im diesem Ausnahme-Genehmigungsverfahren gespielt?
Ich bin Ihnen dankbar für alle weiterführenden Informationen.
Mit freundlichen Grüßen,
Simona Winkler

From: Lukas.WEBER@lebensministerium.at
To: diewinklers@hotmail.com
CC: Matthias.LENTSCH@lebensministerium.at
Date: Fri, 3 Oct 2008 12:53:17 +0200
Subject: AW: Fallstudie Streptomycin
Sehr geehrte Frau Winkler,
im Zusammenhang mit Ihrer zweiten Frage (Rolle des BMLFUW im Zusammenhang mit der Gefahr in Verzug Zulassung) muss ich Sie leider weiter verweisen und zwar an Herr Matthias Lentsch (matthias.lentsch@lebensministerium.at; Tel. 01/71100-2870), wobei ich glaube, dass auch die AGES Ihnen dazu ausreichend Information geben wird können.
Zur Ausnahmeregelung im ÖPUL ist eigentlich nur soviel zu sagen, dass es im Jahr 2008 auf Grund der vorgegebenen Bestimmungen (1.6.10.9 und 1.6.10.10 der Sonderrichtlinie ÖPUL 2007) auch für an der Maßnahme "Integrierte Produktion (IP) Obst und Hopfen" teilnehmende Betriebe möglich war Streptomycin einzusetzen, auch wenn dies in der

verpflichtend vorgeschriebenen Pflanzenschutzmittelliste nicht beinhaltet ist. Dabei wurde jedoch auf diesen Flächen mit Streptomycin-Einsatz keine IP Prämie (300 €/ha) gewährt. Die weitere Vorgangsweise im Jahr 2009 ist noch nicht endgültig festgelegt und hängt auch von den im Jahr 2008 gesammelten Erfahrungen ab. Die Sonderrichtlinie und die Pflanzenschutzmittellisten finden sie auf der Homepage des Lebensministeriums.
Mit freundlichen Grüßen
Lukas Weber-Hajszan
Abteilung II 8, Biologische Landwirtschaft und Agrarumweltprogramme
Stubenring 1, 1012 Wien
Tel. (+43 1) 711 00-6816
Fax (+43 1) 711 00-6507
lukas.weber-hajszan@lebensministerium.at

F) AMA

From: diewinklers@hotmail.com
To: unternehmenskommunikation@ama.gv.at
Subject: Fallstudie an der Universität Wien: Streptomycin – Zulassung
Date: Tue, 15 Jul 2008 11:56:47 +0200
Sehr geehrte Damen und Herren!
Im Rahmen der Diplomarbeit "Wechselwirkungen zwischen Umweltrecht und Wirtschaft" an der Universität Wien (Institut für Energie, Industrie und Umwelt) hat die Causa Feuerbrandbekämpfung mein Interesse geweckt und ich verfasse darüber eine Fallstudie im Rahmen der Diplomarbeit.
Mein Betreuer (Herr DDr. Noll) möchte, dass ich herausarbeite welche Interessensvertretungen hier auf wen Druck ausübten, wer die bestehenden Gesetze zum Verbot des Streptomycins ausgehebelt hat (Instanzenzug), und dass ich Kosten-Nutzen-Relationen aller Alternativen darstelle um die wirtschaftlichen Überlegungen ganzheitlich (wissenschaftlich) abzubilden.
Im Zuge dieser Thematik hätte ich auch versucht über Ihre Homepage eine Stellungnahme zu diesem Thema zu finden, allerdings fehlen hier Inputs zu Streptomycin. Ich würde gerne wissen ob und welcher Form Ihre Organisation hier am Entscheidungsfindungsprozess beteiligt waren und hoffe, dass Sie mir bei meinen Recherchen zu dieser Fallstudie weiterhelfen können, damit ich diese Thema möglichst umfassend und lückenlos beleuchten kann.
Ich wäre Ihnen daher ausserordentlich dankbar, wenn Sie diesbezüglich Zeit für ein Gespräch hätten oder mir mit Informationsmaterial weiterhelfen könnten und verbleibe mit freundlichen Grüßen,
Simona Winkler
Linzerstr. 14
4490 St. Florian
0680-2075465

Date: Tue, 15 Jul 2008 17:54:27 +0200
From: Hermine.Hackl@ama.gv.at
To: diewinklers@hotmail.com
CC: Martin.Gressl@ama.gv.at
Subject: Antw: Wtrlt: Fallstudie an der Universität Wien: Streptomycin – Zulassung
Sehr geehrte Frau Winkler!
Der Leiter unserer Qualitätsmanagement-Abteilung, DI Martin Greßl, wäre da am ehesten der richtige Ansprechpartner dafür. Darf ich Sie bitten, sich unter Tel. 01/33151-444, E-mail: martin.gressl@ama.gv.at gleich direkt an ihn zu wenden?
Mit besten Grüßen
Hermine Hackl
Mag. Hermine HACKL
Leiterin Unternehmenskommunikation
Agrarmarkt Austria Marketing GesmbH.
Dresdner Straße 68a, A-1200 Wien
Tel. *43/1/33151-404
Fax: *43/1/33151-499

Mobil 0664/837 61 78
E-Mail: hermine.hackl@ama.gv.at
Internet: www.ama-marketing.at

From: diewinklers@hotmail.com
To: martin.gressl@ama.gv.at
Subject: Fallstudie an der Universität Wien: Streptomycin – Zulassung
Date: Fri, 18 Jul 2008 03:18:05 +0200

Sehr geehrter Herr Greßl!

Im Rahmen der Diplomarbeit "Wechselwirkungen zwischen Umweltrecht und Wirtschaftsmacht" an der Universität Wien (Institut für Energie, Industrie und Umwelt) hat die Causa Feuerbrandbekämpfung mein Interesse geweckt und ich verfasse darüber eine Fallstudie.

Ich soll herausarbeiten, wie es hier zu der Ausnahmeregelung und Umgehung des Verbots von Streptomycin kam (von welchen Institutionen/Interessensvertretungen das Vorgehen in dieser Richtung gefordert wurde), wer die bestehenden Gesetze zum Verbot ausgehebelt hat (Instanzenzug), und (um die betriebswirtschaftliche Beleuchtung zu vervollständigen) eine Kosten-Nutzen-Rechnung aller Alternativen anstellen.

Über die Suchfunktion auf Ihrer Homepage habe ich leider zum Stichwort Streptomycin keine Ergebnisse gefunden. Ich würde gerne wissen ob und in welcher Form Ihre Organisation hier am Entscheidungsfindungsprozess beteiligt war und welchen Standpunkt Sie in dieser Angelegenheit vertreten. Vor allem erhoffe ich mir auch Informationen wie es zu der Sonderregelung kam, dass der Einsatz von Streptomycin nicht zum Verlust der ÖPUL-Förderung für den gesamten Betrieb, sondern nur zum Abzug der Förderung für behandelte Flächen erfolgt, und andere Spezialfragen, für die Sie mir von Frau Mag. Hermine Hackl als Ansprechpartner empfohlen wurden.

Ich hoffe, dass Sie mir bei meinen Recherchen zu dieser Fallstudie weiterhelfen können, damit ich dieses Thema möglichst umfassend und lückenlos beleuchten kann und wäre Ihnen daher außerordentlich dankbar, wenn Sie diesbezüglich Zeit für ein Gespräch hätten oder mir mit Informationsmaterial weiterhelfen könnten.

Mit freundlichen Grüßen,
Simona Winkler
Linzerstr. 14
4490 St. Florian
0680-2075465

Date: Fri, 18 Jul 2008 13:58:43 +0200
From: Martin.Gressl@ama.gv.at
To: diewinklers@hotmail.com
CC: Harald.Waitschacher@ama.gv.at; Hermine.Hackl@ama.gv.at; Rudolf.Himmelsberger@ama.gv.at
Subject: Antw: Fallstudie an der Universität Wien: Streptomycin – Zulassung

Sehr geehrte Fr. Winkler,

Ich muss Sie leider nochmals auf andere Stellen verweisen, da die AMA Marketing GesmbH der falsche Ansprechpartner ist:

Die Zulassungen zweier Mittel mit Streptomycin ("Strepto" und "Firewall 17 WP") bei Gefahr in Verzug gem. § 13 PMG wurden seitens des Bundesamtes für Ernährungssicherheit (BAES) erstellt.

Für die Fragen zur ÖPUL-Förderung ist weder die AMA Marketing GesmbH noch die AMA als Zahlstelle zuständig, sondern das Lebensministerium (BMLFUW). Ich ersuche Sie daher direkt mit dem zuständigen Sachbearbeiter, Hr. Lukas Weber-Hajszan vom BMLFUW, Kontakt aufzunehmen (Tel. 01/71100-6816).

mfg aus Wien
martin greßl

_____

DI Martin Greßl
Leiter Qualitätsmanagement
Agrarmarkt Austria Marketing GesmbH.
Dresdner Straße 68a
A-1200 Wien
Tel: +43/1/33151-444
Fax: +43/1/33151-499
email: martin.gressl@ama.gv.at

http://www.ama-marketing.at

G) Bauernbund OÖ - NO RESPONSE

From: diewinklers@hotmail.com
To: office@ooe.bauernbund.at
Subject: Fallstudie an der Universität Wien - Zulassung von Streptomycin
Date: Tue, 15 Jul 2008 12:02:54 +0200

H) Globachem – NO RESPONSE

From: diewinklers@hotmail.com
To: globachem@globachem.com
Subject: streptomycin
Date: Wed, 10 Sep 2008 12:26:22 +0200

Subject: RE: streptomycin
Date: Wed, 10 Sep 2008 18:15:53 +0200
From: Koen.Quaghebeur@globachem.com
To: diewinklers@hotmail.com
CC: erwin.zorn@zorn-pflanzenschutz.at
Dear Ms. Winkler,
Thanks for your interest in the product Strepto.
I have put Herr Zorn from Zorn Pflanzenschutz in copy, as he is our distributor in Austria.
He is the best person to reply on your questions.
Can you please contact him ?
Best regards,
Koen Quaghebeur
GLOBACHEM NV
Leeuwerweg 138
B-3803 Sint-Truiden
Belgium
Tel. 0032 11 78 57 17
Fax 0032 11 68 15 65
Mobile 0032 474 95 13 91
Email: koen.quaghebeur@globachem.com
Web: http://www.globachem.com

From: diewinklers@hotmail.com
To: erwin.zorn@zorn-pflanzenschutz.at
Subject: Streptomycin
Date: Thu, 11 Sep 2008 05:35:43 +0200

I) Patty McManus – NO RESPONSE

Patty Mc Manus
mailto:psm@plantpath.wisc.edu
http://www.pen.wisc.edu/mail/mail.php
Referring: Case Study at the University of Vienna - "Agricultural use of Streptomycine"

J) Prof. Tautz – NO INPUTS

From: diewinklers@hotmail.com
To: tautz@biozentrum.uni-wuerzburg.de
Subject: Improved risk assessment of pesticides using fitness tests for honey bees
Date: Thu, 11 Sep 2008 11:35:57 +0200
Sehr geehrter Herr Professor Tautz!
Bei einem Interview zu meiner Diplomarbeitsfallstudie mit dem Oberösterreichischen Bienenvereinspräsidenten, Herrn Mag. Liedlbauer, bin ich auf Ihre Studie "Improved risk assessment of pesticides using fitness tests for honey bees" aufmerksam gemacht worden.
Thema meiner Diplomarbeit: "Interactions of Environmental Law and Economic Power" Fallstudie: "Usage of Streptomycin to combat fire blight in Austria – a cost-benefit-analysis" an der Universität Wien, Institut für Industrie, Energie und Umwelt, Diplomarbeitsbetreuer: DDr. Noll Könnten Sie mir bitte den genannten Artikel weiterleiten, damit ich Ihre Argumente evtl. in meiner Arbeit zitieren kann? Haben Sie auch konkret bezüglich des Streptomycineinsatzes Artikel geschrieben oder andere Inputs, die mir hier weiterhelfen eine Kosten-Nutzen-Rechnung des Antibiotika-Einsatzes umfassend zu erstellen? Ich wäre Ihnen um weiterführende Literatur sehr dankbar.
Mit freundlichen Grüssen,
Simona Winkler

Date: Thu, 11 Sep 2008 11:46:24 +0200
From: Tautz@biozentrum.uni-wuerzburg.de
To: diewinklers@hotmail.com
Subject:
Liebe Simona,
danke für Ihre mail.
Bei dem Beitrag, den Sie zitieren, handelt sich es sich um ein unveröffentlichtes Schriftstück mit dem Hinweis auf die Fitnesstests, die die BEEgroup unter dem Namen BEEgnosis entwickelt hat und weiter entwickelt. Einen Einatz mit Agro-Chemie gab es noch nicht.
Herzlichst,
Ihr Jürgen Tautz.

Prof.Dr.Juergen Tautz
Tel: (49) 931/888-4319
Fax: (49) 931/888-4309
BEEgroup Biozentrum Universitaet Wuerzburg
Am Hubland, D-97074 Wuerzburg, Germany
homepage: http://www.beegroup.de
e-mail:tautz@biozentrum.uni-wuerzburg.de

From: diewinklers@hotmail.com
To: tautz@biozentrum.uni-wuerzburg.de
Subject: RE:
Date: Thu, 11 Sep 2008 11:56:41 +0200
Sehr geehrter Herr Professor!
Bei dem Interview wurde mir eine Ausgabe einer Imkerei-Technik Fachzeitschrift der Berufsimker in Deutschland gezeigt, in welcher eine Zusammenfassung Ihres Artikels in deutscher Übersetzung abgedruckt war!!! Genauer sind meine Aufzeichnungen leider nicht, weil ich annahm auf Ihrer Homepage mehr dazu zu erfahren. Herr Liedlbauer, meinte Sie wären vielleicht jemand der auf diesem Gebiet abschätzen kann, welchen Schaden der Streptomycin-Einsatz nicht nur

am Honigerlös (wegen der etwaigen Kontamination), sondern evtl. auch an den Bienen anrichtet.
Mit freundlichen Grüßen,
Simona Winkler

Date: Thu, 11 Sep 2008 12:19:40 +0200
From: Tautz@biozentrum.uni-wuerzburg.de
To: diewinklers@hotmail.com
Subject:
Liebe Simona,
in dem Beitrag wurde höchstwahrscheinlich aus einem offenen Schreiben von mir zitiert, vermute ich mal. Da wissen Sie mehr als ich ;-)
herzlichst,
Ihr Jürgen Tautz.

Prof.Dr.Juergen Tautz
Tel: (49) 931/888-4319
Fax: (49) 931/888-4309
BEEgroup Biozentrum Universitaet Wuerzburg
Am Hubland, D-97074 Wuerzburg, Germany
homepage: http://www.beegroup.de
e-mail:tautz@biozentrum.uni-wuerzburg.de

Hence: No inputs retrieved

K) GREENPEACE - – NO RESPONSE

To: attila.cerman@greenpeace.at
Subject: Streptomycin Fallstudie an der Uni Wien
Date: Tue, 15 Jul 2008 09:20:07 +0200

ANNEX III to the Case Study: Legal Texts

a) Excursus on 91/414/EEC Article 4 (1) b

(As mentioned before only substances listed in the in the Annex I of the directive are allowed to be used,) "unless it is established, in the light of current scientific and technical kowledge and shown from appraisal of the dossier provided for in Annex III, that when used in accordance with Article 3 (3)[772], and having regard to all normal conditions under which it may be used, and to the consequences of its use:

- it is sufficiently effective;
- it has no unacceptable effect on plants or plant products;
- it does not cause unnecessary suffering and pain to vertebrates to be controlled;
- it has no harmful effect on human or animal health, directly or indirectly (e.g. through drinking water, food or feed) or on groundwater;
- it has no unacceptable influence on the environment, having particular regard to the following considerations:
- its fate and distribution in the environment, particularly contamination of water including drinking water and groundwater,
- its impact on non-target species;"

b) 91/414/EEC Article 4 (1) (b) (iv) and (v)

"Member States shall ensure that a plant protection product is not authorized unless: (b) it is established, in the light of current scientific and technical kowledge [sic!] and shown from appraisal of the dossier provided for in Annex III, that when used in accordance with Article 3 (3)[773], and having regard to all normal conditions under which it may be used, and to the consequences of its use: (iv) it has no harmful effect on human or animal health, directly or indirectly (e.g. through drinking water, food or feed) or on groundwater; (v) it has no unacceptable influence on the environment, having particular regard to the following considerations: — its fate and distribution in the environment, particularly contamination of water including drinking water and groundwater, — its impact on non-target species"

c) 91/414/EEC Annex II-IV Requirements

Requirements of the Annex II - IV from the Council Directive 91/414/EEC (existent data for BP):
"ANNEX II - REQUIREMENTS FOR THE DOSSIER TO BE SUBMITTED FOR THE INCLUSION OF AN ACTIVE SUBSTANCE IN ANNEX I - PART B (Active substances)
1. IDENTITY OF THE MICRO-ORGANISM
1.1. Applicant
1.2. Producer
1.3. Name and species description, strain characterisation
1.4. Specification of the material used for manufacturing of formulated

[772] MS shall prescribe that plant protection products must be used properly. Proper use shall include compliance with the conditions established in accordance with Article 4 and specified on the labelling, and the application of the principles of good plant protection practice as well as, whenever possible, the principles of integrated control

[773] Remark by the author: 91/414/EEC Article 3 (3) says: "Member States shall prescribe that plant protection products must be used properly. Proper use shall include compliance with the conditions established in accordance with Article 4 and specified on the labelling, and the application of the principles of good plant protection practice as well as, whenever possible, the principles of integrated control"

products
1.4.1. Content of the micro-organism
1.4.2. Identity and content of impurities, additives, contaminating microorganisms
1.4.3. Analytical profile of batches
2. BIOLOGICAL PROPERTIES OF THE MICRO-ORGANISM
2.1. History of the micro-organism and its uses. Natural occurrence
and geographical distribution
2.2. Information on target organism(s)
2.2.1. Description of the target organism(s)
2.2.2. Mode of action
2.3. Host specificity range and effects on species other than the target
harmful organism
2.4. Development stages/life cycle of the micro-organism
2.5. Infectiveness, dispersal and colonisation ability
2.6. Relationships to known plant or animal or human pathogens
2.7. Genetic stability and factors affecting it
2.8. Information on the production of metabolites (especially toxins)
2.9. Antibiotics and other anti-microbial agents
3. FURTHER INFORMATION ON THE MICRO-ORGANISM
3.1. Function
3.2. Field of use envisaged
3.3. Crops or products protected or treated
3.4. Method of production and quality control
3.5. Information on the occurrence or possible occurrence of the development
of resistance of the target organism(s)
3.6. Methods to prevent loss of virulence of seed stock of the microorganism
3.7. Recommended methods and precautions concerning handling,
storage, transport or fire
3.8. Procedures for destruction or decontamination
3.9. Measures in case of an accident
4. ANALYTICAL METHODS
4.1. Methods for the analysis of the micro-organism as manufactured
4.2. Methods to determine and quantify residues (viable or non-viable)
5. EFFECTS ON HUMAN HEALTH
TIER I
5.1. Basic information
5.1.1. Medical data
5.1.2. Medical surveillance on manufacturing plant personnel
5.1.3. Sensitisation/allergenicity observations, if appropriate
5.1.4. Direct observation, e.g. clinical cases
5.2. Basic studies
5.2.1. Sensitisation (1)
5.2.2.1. Acute oral toxicity, pathogenicity and infectiveness
5.2.2.2. Acute inhalation toxicity, pathogenicity and infectiveness
5.2.2.3. Intraperitoneal/ subcutaneous single dose
5.2.3. Genotoxicity testing
5.2.3.1. *In vitro* studies
5.2.4. Cell culture study
5.2.5. Information on short-term toxicity and pathogenicity
5.2.5.1. Health effects after repeated inhalatory exposure
(E N D OF T I E R I)
TIER II
5.3. Specific toxicity, pathogenicity and infectiveness studies
5.4. *In vivo* studies in somatic cells
5.5. Genotoxicity — *In vivo* studies in germ cells
(E N D OF T I E R II)
5.6. Summary of mammalian toxicity, pathogenicity and infectiveness
and overall evaluation
6. RESIDUES IN OR ON TREATED PRODUCTS, FOOD AND FEED
6.1. Persistance and likelihood of multiplication in or on crops, feedingstuffs
or foodstuffs
6.2. Further information required
6.2.1. Non-viable residues

6.2.2. Viable residues
6.3. Summary and evaluation of residue behaviour resulting from data submitted under points 6.1 and 6.2
7. FATE AND BEHAVIOUR IN THE ENVIRONMENT
7.1. Persistence and multiplication
7.1.1. *Soil*
7.1.2. *Water*
7.1.3. *Air*
7.2. Mobility
8. EFFECTS ON NON-TARGET ORGANISMS
8.1. Effects on birds
8.2. Effects on aquatic organisms
8.2.1. Effects on fish
8.2.2. Effects on freshwater invertebrates
8.2.3. Effects on algae growth
8.2.4. Effects on plants other than algae
8.3. Effects on bees
8.4. Effects on arthropods other than bees
8.5. Effects on earthworms
8.6. Effects on non-target soil micro-organisms
8.7. Additional studies
9. SUMMARY AND EVALUATION OF ENVIRONMENTAL IMPACT

ANNEX III - REQUIREMENTS FOR THE DOSSIER TO BE SUBMITTED FOR THE AUTHORIZATION OF A PLANT PROTECTION PRODUCT - PART B
1. IDENTITY OF THE PLANT PROTECTION PRODUCT
1.1. Applicant
1.2. Manufacturer of the preparation and the micro-organism(s)
1.3. Trade name or proposed trade name, and manufacturer's development code number of the preparation if appropriate
1.4. Detailed quantitative and qualitative information on the composition of the preparation
1.5. Physical state and nature of the preparation
1.6. Function
2. PHYSICAL, CHEMICAL AND TECHNICAL PROPERTIES OF THE PLANT PROTECTION PRODUCT
2.1. Appearance (colour and odour)
2.2. Storage stability and shelf-life
2.2.1. Effects of light, temperature and humidity on technical characteristics of the plant protection product
2.2.2. Other factors affecting stability
2.3. Explosivity and oxidising properties
2.4. Flash point and other indications of flammability or spontaneous ignition
2.5. Acidity, alkalinity and if necessary pH value
2.6. Viscosity and surface tension
2.7. Technical characteristics of the plant protection product
2.7.1. Wettability
2.7.2. Persistent foaming
2.7.3. Suspensibility and suspension stability
2.7.4. Dry sieve test and wet sieve test
2.7.5. Particle size distribution (dustable and wettable powders, granules), content of dust/fines (granules), attrition and friability (granules)
2.7.7. Flowability, pourability (rinsability) and dustability
2.8. Physical, chemical and biological compatibility with other products including plant protection products with which its use is to be authorised
2.8.1. Physical compatibility
2.8.2. Chemical compatibility
2.8.3. Biological compatibility
2.9. Adherence and distribution to seeds
2.10. Summary and evaluation of data presented under points 2.1 to 2.9
3. DATA ON APPLICATION
3.1. Field of use envisaged
3.2. Mode of action

3.3. Details of intended use
3.4. Application rate
3.5. Content of micro-organism in material used (e.g. in the diluted spray, baits or treated seed)
3.6. Method of application
3.7. Number and timing of applications and duration of protection
3.8. Necessary waiting periods or other precautions to avoid phytopathogenic effects on succeeding crops
3.9. Proposed instructions for use
4. FURTHER INFORMATION ON THE PLANT PROTECTION PRODUCT
4.1. Packaging and compatibility of the preparation with proposed packaging materials
4.2. Procedures for cleaning application equipment
4.3. Re-entry periods, necessary waiting periods or other precautions to protect man, livestock and the environment
4.4. Recommended methods and precautions concerning: handling, storage, transport or fire
4.5. Measures in the case of an accident
4.6. Procedures for destruction or decontamination of the plant protection product and its packaging
4.6.1. Controlled incineration
4.6.2. Others
5. ANALYTICAL METHODS
5.1. Methods for the analysis of the preparation
5.2. Methods to determine and quantify residues
6. EFFICACY DATA
7. EFFECTS ON HUMAN HEALTH
7.1. Basic acute toxicity studies
7.1.1. Acute oral toxicity
7.1.2. Acute inhalation toxicity
7.1.3. Acute percutaneous toxicity
7.2. Additional acute toxicity studies
7.2.1. Skin irritation
7.2.2. Eye irritation
7.2.3. Skin sensitisation
7.3. Data on exposure
7.4. Available toxicological data relating to non-active substances
7.5. Supplementary studies for combinations of plant protection products
7.6. Summary and evaluation of health effects
8. RESIDUES IN OR ON TREATED PRODUCTS, FOOD AND FEED
9. FATE AND BEHAVIOUR IN THE ENVIRONMENT
10. EFFECTS ON NON-TARGET ORGANISMS
10.1. Effects on birds
10.2. Effects on aquatic organisms
10.3. Effects on bees
10.4. Effects on arthropods other than bees
10.5. Effects on earthworms
10.6. Effects on soil micro-organisms
10.7. Additional studies
11. SUMMARY AND EVALUATION OF ENVIRONMENTAL IMPACT

ANNEX IV - STANDARD PHRASES FOR SPECIAL RISKS FOR HUMANS OR THE ENVIRONMENT AS REFERRED TO IN ARTICLE 16

ANNEX VI - PART II - UNIFORM PRINCIPLES FOR EVALUATION AND AUTHORISATION OF PLANT PROTECTION PRODUCTS CONTAINING MICROORGANISMS
A. INTRODUCTION
B. EVALUATION
1. General principles
2. Specific principles
2.1. Identity
2.1.1. Identity of the micro-organism in the plant protection product
2.1.2. Identity of the plant protection product

2.2. Biological, physical, chemical and technical properties
2.2.1. Biological properties of the micro-organism in the plant protection product
2.2.2. Physical, chemical and technical properties of the plant protection product
2.3. Further information
2.3.1. Quality control of the production of the micro-organism in the plant protection product
2.3.2. Quality control of the plant protection product
2.4. Efficacy
2.5. Identification/detection and quantification methods
2.5.1. Analytical methods for the plant protection product
2.5.2. Analytical methods for the determination of residues
2.6. Impact on human and animal health
2.6.1. Effects on human or animal health arising from the plant protection product
2.6.2. Effects on human or animal health arising from residues
2.7. Fate and behaviour in the environment
2.8. Effects on and exposure of non-target organisms
2.9. Conclusions and proposals
C. DECISION-MAKING
1. General principles
2. Specific principles
2.1. Identity
2.2. Biological and technical properties
2.3. Further information
2.4. Efficacy
2.5. Identification/detection and quantification methods
2.6. Impact on human and animal health
2.6.1. Effects on human or animal health arising from the plant protection product
2.6.2. Effects on human or animal health arising from residues
2.7. Fate and behaviour in the environment
2.8. Effects on non-target organisms"

d) [EXTOXNET]

This information sheet taken from [EXTOXNET][774] regarding streptomycin shows how many inputs are still missing:
ACUTE TOXICITY:
The EPA has classified it as Toxicity class IV- relatively non- toxic.
LD50 (dose which kills half of the test animals) is 9,000 mg/kg for rats and >10,000 mg/kg for mice.
CHRONIC TOXICITY:
Reproductive Effects: **n.a. (meaning "No information currently available")**
Teratogenic Effects: Rabbits dosed with 5 or 10 mg/kg/day of streptomycin showed no teratogenic effects.
Mutagenic Effects: **n.a.**
Carcinogenic Effects: **n.a.**
Organ Toxicity: Studies have shown that streptomycin can cause ear damage which is greatest in people exposed for four weeks or more. Can cause kidney damage. In rare cases, streptomycin can cause paralysis.
Fate in Humans and Animals: Topical application or aerosol delivery results in minimal absorption. Streptomycin is not metabolized by the body.
ECOLOGICAL EFFECTS
Effects on Birds: Streptomycin is practically non-toxic to birds.

[774] = Extension Toxicology Network: A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University, and University of California at Davis

Effects on Aquatic Organisms: Streptomycin is practically non-toxic to fresh water invertebrates. It is slightly toxic to warm and cold water species of fish. It is very toxic to algae.
Effects on Other Animals (Nontarget species): used for cats. Dogs which consume streptomycin develop resistance to the compound in the intestinal microorganisms
ENVIRONMENTAL FATE
Breakdown of Chemical in Soil and Groundwater: **n.a.**
Breakdown of Chemical in Water: **n.a.**
Breakdown of Chemical in Vegetation: Residues of streptomycin are not detectable in or on crops when treated according to label use rates and directions. Streptomycin may cause chlorosis to corn, grapes, pears, peaches, and certain ornamentals.
Exposure Guidelines: NOEL: 125 mg/kg/day (rats), ADI: 0.05 mg/kg

e) [ÖPUL 2007]

[ÖPUL 2007] p. 14: "1.6.10.9 Bei flächenverändernden Umständen, auf die der Förderungswerber keinen Einfluss hat und die nicht auf seinen Antrag oder seine Initiative eintreten (zB im Rahmen von Grundstückszusammenlegungsverfahren oder sonstigen öffentlichen Bodenordnungsverfahren, Enteignung, Vorliegen enteignungsfähiger Sachverhalte) und welche die Einhaltung der Verpflichtungen dauerhaft unmöglich machen, kann die AMA die Verpflichtung auf den betroffenen Flächen vorzeitig beenden und von einer Rückforderung bereits gewährter Mittel Abstand nehmen, wenn die verändernden Umstände dem Förderungswerber zum Zeitpunkt der Eingehung der Verpflichtung noch nicht bekannt sein konnten und die vorgesehene Meldung im Rahmen des Mehrfachantrags – Flächen oder spätestens mit der Sachverhaltserhebung zur Verpflichtungsüberprüfung erfolgt.
1.6.10.10 Bei bewirtschaftungsverändernden Umständen, auf die der Förderungswerber keinen Einfluss hat und die nicht auf seinen Antrag oder seine Initiative eintreten (zB veterinärbehördliche Anordnungen, verpflichtende Rodung wegen Feuerbrand) und welche die Einhaltung der Verpflichtung dauerhaft unmöglich machen, kann die AMA die Verpflichtung vorzeitig beenden und von einer Rückforderung bereits gewährter Mittel Abstand nehmen, wenn die verändernden Umstände dem Förderungswerber zum Zeitpunkt der Eingehung der Verpflichtung noch nicht bekannt sein konnten und die diesbezügliche Meldung umgehend erfolgt."

Executive Summary

Generally public goods, of which environmental protection is an example, give rise to market failures because of free-rider- and open access resource problems. Furthermore externalities, asymmetric information, market power and the associated problems lead to insufficient provision of environmental protection. If the market cannot be relied upon to achieve the equilibrium between the competing goals "healthy environment" and (polluting) "economic activities", governmental intervention is necessary. An historical review of the developments in trade regulation, the environmental movement and the European "greening" process is given. Governments need to develop efficient and effective environmental protection frameworks consisting of normative and non-normative instruments to steer the economy towards sustainability and a socially optimal level of environmental protection. A variety of governmental power-instruments is discussed. However, governments, just as the free market, do not necessarily produce the best results: the choice and correct application of strategies can be frequently flawed by government failures - decisions being subject to bias because of information failures, individualistic behaviour and bad management. Clearly, the higher the impacts of governmental interference and regulation on companies, the more resistance can be expected. Anticipated counter pressure opportunities of businesses are listed by their rising grade. The role of governments is to integrate the consideration of risks and impacts on the environment into the set of managerial decision-making-processes of the economy, without taking over responsibility and diminishing economic flexibility. Environmental policy has to balance conflicting demands efficiently and effectively through the appropriate use of instruments. Ideally governmental decision processes are guided by social cost benefit analyses, assigning values to tangible, but also intangible impacts (such as the quality of life). The full social costs of certain economic activities are highly interdependent and synergistic; the calculation is therefore very sophisticated and requires expert knowledge (that may not be wholly objective). National political activities as a whole include many unsustainable initiatives: partly because environmental protection is not the first priority of many governmental departments, and because those governmental departments, for which environmental protection should be a priority, fail to withstand counter-pressures of the regulated economic players. Therefore academia needs to assist with more research on the institutional setting of the policy-making process, in order to achieve that environmental concerns are taken seriously. Yet, the author experienced a severe gap in academic literature

regarding the use of economic power to oppose environmental policy and hopes that more attention will be paid to this topic in future.

The **case study** reveals an incident of interaction of governmental and economic power: the intervention to achieve the authorisation of the antibiotic "streptomycin" for agricultural use against fire blight in Austria, although actually forbidden in the EU, by "danger-in-delay"-exemption. Fire blight is an highly infectious plant disease, caused by the bacteria "Erwinia amylovora", affecting several pome fruit trees of high commercial interest such as apple, pear and quince. Consequently the occurrence of fire blight in orchards can cause severe economic damage. Since there are no cures the plant-pathogen has been found hard to control worldwide. In Austria controversies have arisen regarding the preventative use of streptomycin, because of possible consequences, which are e.g.: environmental deterioration (disturbances in soil equilibrium, water contamination, damaging small aquatic organisms), health hazards (rising resistance to antibiotics, allergies) and economic damage (possible contamination of honey, image losses). Other preventative measures, besides streptomycin, exist. In the study, the environmentally safe product "Blossom Protect" and the antibiotic are contrasted in a social cost benefit analysis. The case showed that market failures correlating to the issue have made governmental interference necessary. But also governmental failures have been identified by the author, which are information failures towards the public ("no health risks", uncommon information policy, missing transparency and neglected "public's right to know"), but also towards the pome-fruit orchardists (non-information on the negative effects of streptomycin, dismissing existing alternatives). Further governmental failures such as regulatory captures and deficient management (due to missing consolidated data, decisions in the absence of a cost benefit analysis), amongst others, are detected. Furthermore the seemingly unreasonable withdrawal of the AMA quality seal for acreages treated with the plant protection product Blossom Protect (allowed in organic farming), is judged to have been some kind of "act of reprisal" against the producers: they had been suspected to have caused the media hype drawing public attention towards the issue of the agricultural use of the antibiotic. To acquire the necessary expert knowledge, interviews with qualified representatives of stakeholders have been held. The author has tried to assess the bargaining process regarding the authorisation of the use of streptomycin and the stakeholders' possibilities to wield power.

Zusammenfassung

Kollektivgüter, wie zum Beispiel Umweltschutz, haben (u.a.) wegen der Trittbrettfahrer- und der Allmendeproblematik Marktversagen zur Folge. Auch die mit negativen externen Effekten, asymmetrischer Information und Marktmacht verbundenen Probleme führen zu unzureichendem Umweltschutz. Wenn der freie Markt kein zuverlässiges Gleichgewicht zwischen den konkurrierenden Zielen „gesunde Umwelt" und (umweltverschmutzenden) „ökonomische Aktivitäten" herstellen kann, ist staatliches Eingreifen notwendig. In einem geschichtlichen Rückblick werden Entwicklungen des Handelsrechts, das Entstehen der Umweltbewegung und des Europäischen Umweltprozesses dargestellt. Regierungen müssen mittels Rechtsgrundlagen und anderen Instrumenten effiziente und effektive Umweltschutzsysteme entwerfen, um die Wirtschaft auf nachhaltige Pfade zu lenken, damit das gesamtpolitisch optimale Umweltschutz-Niveau erreicht werden kann. Eine Reihe von Möglichkeiten Staatsmacht einzusetzen wird beschrieben. Allerdings können Regierungen, so wie auch der freie Markt, zu sub-optimalen Resultaten führen: Mängel in der Festlegung und Umsetzung von Strategien führen oft zu Staatsversagen (Entscheidungen aufgrund von Informationsfehlern, Eigennutzenmaximierung und Misswirtschaft). Je größer die Auswirkungen von staatlichen Eingriffen und Regulierungen sind, desto mehr Widerstand wird von den (betroffenen) Firmen erwartet werden müssen. Voraussichtliche Gegendruck-Maßnahmen der Wirtschaft sind ihrem steigenden Grade nach angeführt. Rolle der Regierungen ist es, Überlegungen bezüglich Umwelt-Auswirkungen und Risiken in betriebliche Entscheidungsprozesse einfließen zu lassen, ohne dabei Verantwortung abzunehmen und die Flexibilität von Betrieben einzuschränken. Aufgabe der Umweltpolitik ist es, die Ausgewogenheit kollidierender Anforderungen durch den Einsatz geeigneter Instrumente effizient und effektiv herzustellen. Idealerweise orientiert sich der staatliche Entscheidungsprozess dabei an einer Social-Cost-Benefit-Analyse, die sowohl materiellen, als auch immateriellen Auswirkungen (wie z.B. die Lebensqualität) Rechnung trägt. Die gesellschaftlichen Vollkosten gewisser ökonomischer Aktivitäten sind sehr verflochten und haben synergistischen Charakter; die Berechnung ist daher äußerst kompliziert und erfordert (eventuell nicht objektives) Fachwissen. Die Gesamtheit der politischen Betätigungen in einem Land besteht aus vielen nicht nachhaltigen Initiativen; teilweise aufgrund der mangelnden Priorität des Umweltschutzes in manchen Ressorts, aber auch weil Institutionen, die Umweltschutz sogar als Priorität hätten, dem Gegendruck der regulierten Wirtschaftssubjekte nicht standhalten.

Es obliegt daher der akademischen Welt durch Erforschung der institutionellen Rahmenbedingungen politischer Prozesse Unterstützungsarbeit zu leisten, damit Umweltfragen (besser) Gehör finden. Bezüglich des Einsatzes von Wirtschaftsmacht, um sich der Umweltpolitik zu widersetzen, bietet die wissenschaftliche Literatur, nach den Erfahrungen der Verfasserin, derzeit noch sehr wenig Anhaltspunkte und es wird auf mehr zukünftige Beachtung dieser Thematik gehofft.

Die **Fallstudie** untersucht ein Begebnis der wechselseitigen Beeinflussung von staatlicher und ökonomischer Macht: die Erlangung einer „Gefahr im Verzug"-Ausnahmegenehmigung des in der EU verbotenen Antibiotikums „Streptomycin" für den landwirtschaftlichen Einsatz gegen den Feuerbrand in Österreich. Feuerbrand ist eine hochinfektiöse Pflanzenkrankheit, die von dem Bakterium „Erwinia amylovora" hervorgerufen wird, und mehrere Kernobstbaumsorten von hohem gewerblichem Interesse befallen kann, wie z.B. Apfel, Birne und Quitte. Das Auftreten von Feuerbrand in Obstplantagen kann daher beachtlichen ökonomischen Schaden anrichten. Nachdem es keine Heilmittel gibt, fällt es weltweit schwierig den Krankheitserreger einzudämmen. In Österreich hat der präventive Einsatz von Streptomycin wegen u.a. folgender möglicher Konsequenzen zu Unstimmigkeiten geführt: Umweltschädigung (Störung des Gleichgewichts im Boden, Kontaminierung des Wassers, Schädigung von Fischnährtieren), Gesundheitsrisiken (zunehmende Antibiotikaresistenzen, Allergien) und ökonomische Schädigung (mögliche Belastung des Honigs, Imageverlust). Abgesehen von Streptomycin existieren aber auch noch andere präventive Maßnahmen. In der Studie werden das für die Umwelt harmlose Pflanzenschutzmittel „Blossom Protect" und das Antibiotikum in einer Social-Cost-Benefit-Analyse einander gegenübergestellt. Der Fall hat gezeigt, dass auftretende Marktfehler in diesem Fall das Eingreifen des Staates notwendig gemacht haben. Aber es wurden auch Staatsversagen in Form von Informationsfehlern in Richtung Öffentlichkeit („kein Gesundheitsrisiko", eigenartige Informationspolitik, fehlende Transparenz und missachtetes Recht des Zugangs zu Informationen) und in Richtung der Erwerbsobstbauern (fehlende Aufklärung über die negativen Auswirkungen des Streptomycin-Einsatzes, Abtun existierender Alternativen) festgestellt. Weiters wurde „Regulatory Capture", unzureichendes Management (aufgrund fehlender konsolidierter Daten und des Fällens von Entscheidungen in Ermangelung einer Cost-Benefit-Analyse) und auch andere Staatsversagen festgestellt. Zudem wurde das AMA-Gütesiegel für die mit dem Pflanzenschutzmittel Blossom Protect behandelten Flächen, aus völlig

unverständlichen Gründen, ausgesetzt. Dabei muss es sich wohl um einen „Vergeltungsschlag" gegen die Produzenten des alternativen Produktes gehandelt haben, die mit dem, um die landwirtschaftliche Verwendung von Antibiotika herum entstandenen, Medienrummel in Zusammenhang gebracht wurden. Für die Aneignung des nötigen Expertenwissens wurden kompetente Vertreter verschiedener Stakeholder interviewt und der Versuch angestellt, die jeweiligen Möglichkeiten der Machtausübung im Hinblick auf die Zulassung von Streptomycin zu bewerten.

Curriculum Vitae

Simona C. Winkler

Linzerstr. 14, A-4490 St. Florian, Österreich
Geburtsort, -datum: Linz, 24.08.1976
Familienstand: verheiratet, zwei Töchter

Ausbildung

1983 bis 1985	Volksschule, Puchenau, Österreich
1985 bis 1989	German Swiss International School, Hongkong
1989 bis 1995	Bundesgymnasium Khevenhüller, Linz, Österreich
Sommersemester 1995	Matura
Wintersemester 1995/6	Beginn des Studiums der Internationalen Betriebswirtschaftslehre (IBWL) an der Universität Wien, Betriebswirtschaftliches Zentrum (BWZ)
Wintersemester 2001/2	Auslandssemester an der Universidad de Alicante, San Vicente del Raspeig, Spanien
Sommersemester 2002	Unterbrechung des Studiums
Wintersemester 2007/8	Fortsetzung des Studiums
Wintersemester 2008/9	Fertigstellung des Studiums

Spezialisierung im Studium

Allgemeine BWL: Marketing, Organisation und Planung

Besondere BWL: Wirtschaftsinformatik
Internationales Management: Internationales Marketing, Internationale Unternehmensführung
Wahlfach: Umweltökonomie
Sprachen: Englisch und Spanisch

Praktika, Arbeitserfahrung

August 1993	**VOEST Alpine Industrieanlagenbau (Linz, Österreich)** *Ferialpraxis* Sekretariat der Abteilung „TWW4"
August 1995	**Rosenbauer International AG (Pasching, Österreich)** *Ferialpraxis* Einkauf
Juli 1996	**VOEST Alpine Industrieanlagenbau (Linz, Österreich)** *Ferialpraxis* Bankenabteilung (FBV)
September 1996	**Rosenbauer International AG (Pasching, Österreich)** *Ferialpraxis* Controlling, Konzernmarketing
August 1997	**Rosenbauer International AG (Pasching, Österreich)** *Ferialpraxis* Konzernmarketing

Juli, August 1998	**Rosenbauer International AG (Pasching, Österreich)** *Ferialpraxis* Projekt „Durchgehende Datenbasis"
Okt. 1998- Okt. 2000	**Rosenbauer International AG (Pasching, Österreich)** *Werkstudent (Anstellung als „Programmierer")* Projekt „Durchgehende Datenbasis"
1999-2001	**Kingshill Investments Co., Ltd. (Hong Kong)** *Marketing (in Australien, China und Hong Kong)* Organisation und Durchführung von Messen (China Food Fair, Fine Food Australia, IBA), Seminare, Kundenbesuche. Z.B.: September 1999: Shanghai August - September 2000: Beijing, seminar-tour through China, Sydney, Melbourne, Brisbane, Gold Coast, Perth Juli - September 2001: Hong Kong; Shanghai, Sydney, Melbourne