Assessing farmers' cost of compliance with EU legislation in the fields of environment, animal welfare and food safety

FINAL REPORT

Commissioned by the
European Commission
Directorate-General for Agriculture and Rural Development.

AGRI-2011-EVAL-08

Study undertaken by:

CRPA - Centro Ricerche Produzioni Animali (IT)

In association with:

TI - Thünen Institute of Farm Economics (DE)

IFCN - International Farm Comparison Network on Dairy (DE)

UGHENT – University of Ghent (BE)

Authors

Alberto Menghi, Kees de Roest, Andrea Porcelluzzi (CRPA)

Claus Deblitz, Zazie von Davier, Barbara Wildegger, Thomas de Witte, Kathrin Strohm, Hildegard Garming, Walter Dirksmeyer, Yelto Zimmer (Thünen Institute of Farm Economics)

Dorothee Bölling (IFCN), Guido van Huylenbroek, Evy Mettepenningen (UOGHENT)

Table of contents

List of tables

Authors

Alberto Menghi, Kees de Roest, Andrea Porcelluzzi (CRPA)

Claus Deblitz, Zazie von Davier, Barbara Wildegger, Maria Dolores Izquierdo Lopez, Thomas de Witte, Kathrin Strohm, Hildegard Garming, Walter Dirksmeyer, Yelto Zimmer (Thünen Institute of Farm Economics)

Dorothee Bölling (IFCN)

With the collaboration of the following experts:

Theoretical framework

- Guido Van Huylenbroeck, Valerie Vandermeulen, Evy Mettepenningen, Louis Mahy (University of Gent)

Dairy

- Dorothee Bölling, Torsten Hemme (IFCN)
- Anna-Maija Heikkilä, Sami Ovaska (MTT Economic Research)
- Fiona Thorne, Cathal Buckley (TEAGASC)
- M.H.A. (Michel) de Haan (Wageningen UR Livestock Research)
- Ewa Koloszycz (Zachodniopomorski Uniwersytet Technologiczny)
- Hugo Quattrochi (private consultant)
- Nicola M Shadbolt (Massey University)

Beef meat

- Claus Deblitz, Zazie von Davier, Barbara Wildegger, Maria Dolores Izquierdo Lopez (Thünen Institute of Farm Economics)
- Emma Sanne (Institute de l´Élevage)
- Claudio Montanari, Paolo Demaria, Valeria Musi, Claudia Severi (CRPA)
- Mark Topliff, Carol Davis (Agriculture and Horticulture Development Board)
- Bernado Ostrowski (Universidad de Buenos Aires)
- Sergio de Zen (University of São Paolo)

Sheep meat

- Claus Deblitz, Zazie von Davier, Barbara Wildegger, Maria Dolores Izquierdo Lopez (Thünen Institute of Farm Economics)
- Vincent Bellet (Institute de l´Élevage)
- Mark Topliff, Carol Davis (Agriculture and Horticulture Development Board)
- Karl Behrendt (Charles Sturt University)
- Lloyd Davies (Charles Sturt University)
- Tony Rhodes (PGG Wrightson Consulting)

Pork meat

- Kees de Roest, Paolo Ferrari, Paolo Demaria, Valeria Musi, Claudia Severi (CRPA)
- Michael G. Christiansen (Pig Research Center)
- Gerhard Haxsen (Thünen Institute of Farm Economics)
- F.C.N.M. (Franklin) Josten (DLV Intensief Advies BV)
- Edward Majewski, Agata Malak-Rawlikowska (Warsaw University of Life Sciences)
- Ari Jarbas Sandi, Everton Luis Krabbe, Franco Müller Martins, Gustavo Lima, Helenice Mazzuco, Janice R. Ciacci Zanella, Julio Cesar P. Palhares, Marcelo Miele, Marcos A. Zanella Morés, Martha Mayumi Higarashi, Nelson Morés, Osmar A. Dalla Costa, Rodrigo Nicoloso (EMBRAPA)
- Dermot Hayes (Iowa State University)

Broilers

- Claude Aubert, Pascale Magdelaine, Isabelle Bouvarel, Romaric Chenut (ITAVI)
- Laura Valli, Liliana Cortellini, Kees de Roest, Paolo Demaria, Valeria Musi, Claudia Severi (CRPA)
- Klaus Damme, Stefanie Urselmans (Bayerische Landesanstalt für Landwirtschaft)
- Ari Jarbas Sandi, Clarissa Silveira Luiz Vaz, Everton Luis Krabbe, Franco Müller Martins, Helenice Mazzuco, Julio Cesar P. Palhares, Liana Brentano, Marcelo Miele, Martha Mayumi Higarashi, Rodrigo Nicoloso (EMBRAPA)
- Uthai Kanto, Sasitorn Nakthong (Kasetsart University)
- Peter Van Horne (Wageningen UR, LEI)

Wheat

- Thomas de Witte (Thünen Institute of Farm Economics)
- Bernd Rodemann (Julius Kühn Institute)
- Michael Stensgaard Toft (Patriotisk Selskab)
- Roman Slaston (Ukrainian Agribusiness Club)
- Mark Bieri (University of Cambridge)
- Boldizsár Megyesi (Hungarian Academy of Sciences)
- Richard Schoney (University of Saskatchewan)

Apples

- Kathrin Strohm, Hildegard Garming, Walter Dirksmeyer (Thünen Institute of Farm Economics)
- Matthias Görgens (Obstbauzentrum Jork)
- Manfred Büchele, Elke Pollok (Kompetenzzentrum Obstbau Bodensee)
- Valeria Altamura, Davide Barbieri (CRPV)
- Ricardo Adonis (Fundación para el Desarrollo Fruticola)
- Jan Lombard (University of Stellenbosch)
- Mariette Kotze (Hortgro)

Wine grape

- Kathrin Strohm, Hildegard Garming, Walter Dirksmeyer (Thünen Institute of Farm Economics)
- Zlatan Vassilev (private consultant)
- Alfredo Coelho, Etienne Montaigne (UMR MOISA SupAgro-INRA)
- Valeria Altamura, Davide Barbieri (CRPV)
- Alicia Langreo (Saborá, Estrategias Agroalimentarias)
- Randy Stringer, Wendy Umberger, Camilo Esparza Garcia (University of Adelaide)
- Jan Lombard (University of Stellenbosch)
- Gert van Wyk, Pieter van Niekerk (Vinpro)

List of abbreviations

ABIEC: Associação Brasileira das Industrias Exportadoras de Carne (Brasil)
AW: animal welfare legislations
BATs: best available technologies
BF: agribusiness farm
BREFs: best available techniques reference documents
CIREN: National Resources Information Centre (Chile)
CF: cooperative farm
CRPA: Centro Ricerche Produzioni Animali (Italy)
CRPV: Centro Ricerche Produzioni Vegetali (Italy)
CW: carcass weight
DEFRA: Department for Environment, Food and Rural Affairs (United Kingdom)
DG AGRI: Directorate-General for Agriculture and Rural Development
EC: European Commission
ECM: energy corrected milk
EMBRAPA: Empresa Brasileira de Pesquisa Agropecuária (Brazil)
ENV: environment legislations
ESYRCE: Ministerio de Agricoltura, Alimentacion y Medio Ambiente (Spain)
EU: European Union
FAO: Food and Agriculture Organisation
FFB: family farm business
FS: food safety legislation
GAECs: good agricultural and environmental conditions
GAPs: good agricultural practices
GDP: gross domestic product
HORTGRO: Horticultural Knowledge Group (South Africa)
IBGE: Instituto Brasileiro de Geografia e Estatistica (Brazil)
IFCN: International Farm Comparison Network
IPPC: Integrated Pollution Prevention and Control Directive
ISTAT: National Institute of Statistics (Italy)
ITAVI: Institut Technique de l'Aviculture (France)
K: potassium
LEI: Landbouw-Economisch Intituut (Netherlands)

MINAGRI: Ministerio de Agricoltura, Ganaderia y Pesca (Argentina)

ND: Nitrate Directive

NVZ: nitrate vulnerable zone

TCE: transaction costs economics

N: nitrogen

P: phosphorus

SAWIS: South Africa Wine Industry Information and Systems (South Africa)

STATCAN: National Institute of Statistics (Canada)

SW: slaughter weight

UKRSTAT: National Institute of Statistics (Ukraine)

UN: United Nations Organisation

TEAGASC: Irish Agriculture and Food Development Authority (Ireland)

TI: Thunen Istitute of Farm Economics (Germany)

1. Introduction

1.1. Context of the study

In the 1980s and 1990s, public concern rose regarding the negative environmental impact of intensive farming practices. Increased awareness of air pollution as well as ground and surface water pollution due to intensive livestock activities stimulated public intervention. This resulted in a series of environmental regulations like the Nitrate Directive, the Water Framework and the Integrated Pollution Prevention and Control (IPPC) Directive. Their objective is to internalize negative externalities into the farm balance. The legislation creates extra costs for farmers who must comply with this legislation, but it generates an agriculture with high level standards of animal welfare, food safety and environment which meets the expectations of consumers and citizens in the EU Member States and in Third Countries

Present-day consumers and citizens have become more sensitive to the welfare of farm animals. Nowadays, animal welfare has become part of the concept of *public concern*, where the repeated consumption of livestock products derived from poorly kept animals by one group of consumers generates *psychological externalities* to other groups who are concerned about the welfare of farm animals. This has led to the issuing of EU animal welfare legislation throughout the 90s and the first decade of the 21st century. Such legislation might generate extra costs to farmers, but these costs may be significantly mitigated by productivity gains of animals raised under better conditions.

Finally, the food scandals that struck the agribusiness industry during the last twenty years have frequently caught public's attention. The untrustworthy behaviour and illegal practices of some actors in the food supply chain have caused considerable damage to human health and significant economic losses to society. Therefore, food safety regulations were created to prevent and limit the occurrence of diseases and illegal practices which caused these food scandals. Mad cow disease and dioxin contaminated eggs are two memorable cases. Examples of public intervention in the field of food safety are the identification and registration of cattle, as well as the full traceability of food products throughout their production chain. This type of legislation meets consumers' demand for food produced with high food safety standards.

From a general perspective, regulations in the fields of the environment, animal welfare and food safety have the potential to generate a cost increase at the farm level. Hence, the global competitiveness of European agriculture may be affected by these standards. However, compliance costs do not necessarily damage the competitive position of the EU on export markets, as these

standards raise the quality and reliability of EU food products on the world market. In fact, in some cases the cost increase has been fully absorbed within the food supply chain. Moreover, as EU policies in the fields of the environment, animal welfare and food safety have progressed substantially in the last decades, similar legislation has been adopted in Third Countries that are import and export partners of the EU. Therefore, farmers in these countries may equally face compliance costs. A comparative analysis of the enforced legislation and the resulting costs of compliance in both EU Member States and third countries is of utmost importance in assessing the relative competitive position of the EU on the world market.

1.2. Objectives of the study

The objective of the study includes the provision of relevant background information concerning public interventions in the agricultural sector and their economic impact at farm level. It entails a comprehensive and comparative assessment of the actual costs that EU farmers bear due to compliance with legislation in the fields of the environment, animal welfare and food safety. Within this broad sphere of activity, a set of specific goals is identified:

1. To provide a comprehensive description and assessment of the costs of compliance with EU legislation in the fields of environment, animal welfare and food safety at farm level in selected EU Member States;
2. To provide a comprehensive description and assessment of the costs of compliance for farmers in a number of third countries with equivalent legislation in their respective countries, as well as with EU legislation as exporters to the EU;
3. To compare the costs of compliance with environmental, animal welfare and food safety legislation for EU and third country farmers and to draw conclusions with respect to the impact on competitiveness.

1.3. Scope of the study

Agricultural products are increasingly exchanged on the world market. An analysis of the costs of compliance with legislation and their share in total production costs needs careful attention, as this potentially may have an impact on world trade in agricultural products. The research has been designed within set limits regarding the examination period, the legislation, the geographical coverage, and the sectors involved.

1.3.1. Examination period

An examination period is defined to ensure the comparability of the compliance costs assessment. Such period must be as recent as possible. The year 2010 is established as the reference year for this study. All cost calculations presented in the study are related to this year and refer to legislation introduced in the past. Legislation issued but not yet implemented in 2010 has been taken into account as well in this study on the condition, that it contains clear obligations. Examples are the animal welfare legislation for pigs and the welfare directive for broilers both issued before 2010, but enforced only later.

1.3.2. Selected relevant legislation

The set of legislation chosen include directives and regulations in the fields of the environment (e.g. protection of groundwater; quality of water, air and soil; conservation of habitats and species), animal welfare (e.g. housing systems; space allowances; minimum roughage levels in feed), and food safety (e.g. identification and registration of animals; implementation of food traceability systems; prohibition of hormones). In collaboration with the Steering Committee and the country experts, a selection was made of those directives and regulations which could generate relevant compliance costs for farmers. This selection process resulted in a group of 40 EU Directives and Regulations, as well as the GAECs[1] which directly affect farmers in the EU (for a complete list see Annex 1 of the report). Regulations relevant to the feed industry were included to consider indirect effects on farmers such as for example higher feed prices. In the Third Countries, legislation was selected which is equivalent or similar to EU legislation. Private standards have been considered only when they are compulsory to access the export market to EU Member States.

The Habitat Directive has not been selected for this study. Often, farmers' compliance costs caused by the constraints from the management plans of the Natura 2000 areas, are compensated by the agri-environmental payments of the Rural Development Plans[2] .The Water Framework Directive has been excluded from this study as well: when this study was conducted, Member States had not yet detailed the measures for farmers in the River Management Basin plans.

[1]Good Agricultural and Environmental Conditions

[2]For a full documentation about the costs and benefits of these Directives see: Costs and socio-economic benefits associated with the Natura 2000 Network. IEEP, GHK, Ecologic, EU study ENV.B2/SER/2008/0038, October 2010

1.3.3. Geographical coverage and selected agricultural sectors

The study focuses on the major and most representative agricultural sectors in the EU, specifically: cow milk; beef, sheep, pork, and poultry (broilers); cereals (wheat); fruits (apples); and wine grapes. The research is intended to provide an overview of the competitive situation of these agricultural sectors in the EU, with a higher level of detail for a number of selected Member States. A set of Third Countries is included for comparison purposes.

The analysis was performed by surveys designed to describe the relevant legislation and by means of case studies, which allow for a quantitative cost assessment. The outcome (Table 1.1) is a series of 43 case studies, involving 12 EU Member States and 10 Third Countries centred on 8 agricultural sectors. Therefore, the study can only provide hints, but it is not possible to draw general conclusions on the EU farmers' situation.

Table 1.1 – Countries and sectors investigated in the project

Countries	case studies	dairy	beef	sheep	pork	poultry	wheat	apple	wine
European Union									
Bulgaria	1								x
Denmark	2				x		x		
Finland	1	x							
France	4		x	x		x			x
Germany	5	x			x	x	x	x	
Hungary	1						x		
Ireland	1	x							
Italy	4		x			x		x	x
Poland	2	x			x				
Netherlands	2	x			x				
Spain	1								x
United Kingdom	3		x	x			x		
Total	**27**	**5**	**3**	**2**		**3**	**4**	**2**	**4**
Third Countries									
Argentina	2	x	x						
Australia	2			x					x
Brazil	3		x		x	x			
Canada	1						x		
Chile	1							x	
New Zealand	2	x		x					
South Africa	2							x	x
Thailand	1					x			
Ukraine	1						x		
USA	1				x				
Total	**16**	**2**	**2**	**2**		**2**	**2**	**2**	**2**

The criteria for the selection process of the sectors and countries have been the following:

- list of sectors indicated in the call;
- list of countries indicated in the call;
- recommendations emerging from the reviewed literature;
- relevance of the country in the specific sector;
- relevance of the third country from which the EU is importing;
- relevance of the third country to which the EU is exporting;
- relevance of the country concerning the legislation protecting the environment, animal welfare and food safety.

2. Theoretical framework

This second chapter details the theoretical foundation of the study, which is essential for achieving the objectives of the study. With this purpose in mind, a set of research questions was defined to guide the analytical process:

- What are potentially the farmers' compliance costs with EU legislation that regulates environmental protection, animal welfare, and food safety?
- What are potentially the farm-level benefits from compliance with EU legislation in the fields of environmental protection, animal welfare, and food safety?
- What is the influence of the cost of compliance on the competitiveness of European farmers on the global marketplace?

2.1. Conceptual framework

The conceptual framework of the research is twofold and based on partial budgeting and the economic engineering approach, which in turn is rooted in neo-classical production theory. This theory is concerned with the strategies that firms adopt when choosing how to employ limited resources with alternative uses with the purpose of generating economic goods and services for present and future consumption. Neo-classical economic theory is based on the following primary assumptions: (1) individuals are rational; (2) they aim at maximising their utility, or profits in the case of business ventures; and (3) they act independently on the basis of full information (Ferguson, 2008). In the following pages, the leading principles of neo-classical production theory is explained, together with the specifics of their application to partial budgeting.

2.1.1. Neoclassical production theory and partial budgeting

Our focus is the farm, modelled as a production unit run by a rational, fully-informed farmer, who aims at maximising profit. Therefore, the optimal combination of inputs or production factors is sought in the production process to generate certain outputs. Four main types of **production factors** can be distinguished: (1) land, referring to all raw materials available in nature; (2) labour, or the human physical and mental skills that can be used in the production of goods and services; (3) capital, or man-made aids to the production process like machinery and buildings; and (4) entrepreneurship, or management skills. The combination of production factors selected by each

farmer depends upon a number of elements, namely the price of the production factors, the price of alternative outputs, and the technology available at the moment, and the geographical and environmental circumstances in which he/she operates. Note that references to input and output prices are actually intended as opportunity costs. The opportunity cost of an input is defined as the value of said input in its best alternative use, which corresponds to the market price in well-functioning markets. Good decisions stem from reasoning that takes into account economic costs (the accounting costs that were actually paid), as well as the opportunity cost of unpaid (family) labour, buildings, etc. (Ferguson, 2008, Parkin *et al.*, 2008).

The concept of **efficiency** can be defined as the characterisation of how successful a farmer is a generating his/her income. A distinction can be made between technical and allocative efficiency. Technical efficiency is the ability to obtain a maximum output from given inputs, which corresponds to maximising the production function. Allocative efficiency is the ability to use inputs in optimal proportions given their prices, which corresponds to maximising the profit function (total revenues minus total costs). The relative efficiency of a farm can be determined based on data envelopment or stochastic frontier analysis (Coelli *et al.*, 2005).

Legislation in the field of the environment, animal welfare, or food safety, influences both the production process and farm management. These influences are related to the requirements that regulations impose, i.e. a reduction in the use of certain inputs might be demanded (e.g. fertilisers, or number of animals in the case of environmental policy), or their increase (e.g. extra labour required to register animals to comply with food safety legislation), or else a shift to different inputs (e.g. another type of stable to comply with animal welfare legislation). The resulting changes in the farmer's production function(s) can have an effect on the output(s), and, together with a change in input prices, they have the potential to influence the profit function. In other economic sectors, producers are likely to translate higher input costs into higher output prices to the consumer. This is however often difficult for farmers, as they are price-takers for most agricultural products (Brouwer *et al.*, 2011). Farmers are typically operating in a polypoly market characterized by an atomized market structure: a huge number of suppliers facing a limited number of buyers. In these types of markets farmers do not have the power to transfer an increase of production costs due to compliance with legislation into higher prices at wholesale and a retail level. The market power of farmers is limited.

Legislation can affect the agricultural business directly and/or indirectly through other supply chain actors such as animal transportation (i.e. in the case of legislation on animal welfare) or food

processing and feed mills (i.e. in the case of legislation on food safety). Therefore, including the agricultural supply chain in the analysis is crucial to obtaining sound results. In fact, when stricter regulations regarding the environment, animal welfare, and food safety affect the upstream or downstream nodes of the supply network, they might transfer these extra costs to the farmers. (Brouwer *et al.*, 2011).

For the purposes of this project, **partial budgeting** is used to assess the effects of the environment, animal welfare, and food safety legislation on farm management and profit (Boehlje and Eidman, 1984). The methodology is based on the neo-classical economic principles explained in the previous paragraph that describe the impact on the different elements of the production and profit functions. The *partiality* is due to the fact that only those elements of the total farm budget are considered when the legislation is implemented (Dijkhuizen and Morris, 1997). Such changes in farm management are expressed as additional/reduced costs and additional/reduced returns, which are measured by means of balance sheets (Dalsted and Gutierrez, 2010).

The insight into cost factors provided with neo-classical production theory does not include transaction costs. Yet, compliance with legislation in the fields of the environment, animal welfare, and food safety often creates a significant increase in transaction costs in the form of additional administration. Therefore, in the following section, the major principles of transaction cost theory will be briefly explained.

2.1.2. Transaction costs theory

As opposed to neo-classical production theory, transaction cost theory is part of the New Institutional Economics paradigm. This paradigm is often described in economic theory as "expanded neoclassical economics" (Williamson, 2003), as it adds institutions as a critical constraint in decision-making by analysing transaction costs as a connection between institutions and production costs (North, 1993; Doner and Schneider, 2000). North (1991, p. 97) defines institutions as «the humanly devised constraints that structure political, economic and social interaction», which contain both formal legislation and informal rules and norms. The institutions we are interested in is the European legislation regarding the environment, animal welfare, and food safety.

The concept of transaction costs was first introduced by Coase (1937) in his famous paper "The nature of the firm", in which he explains why some transactions are conducted on the market whereas others take place within a firm. Coase states that using the market involves extra costs like searching for information, bargaining and signing contracts. He affirms that by organising activities under the agent's own supervision, these costs can be decreased or eliminated. It was mainly Oliver E. Williamson who then further developed these concepts by laying the theoretical foundations of Transaction Cost Economics (TCE) theory. According to Williamson, «a transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates and another begins» (Williamson, 1985, p. 1). One of the basic concepts of TCE is its consideration of the transaction of a good or service as the basic unit of analysis (see e.g. Commons, 1934; Williamson, 1985; Williamson, 1996; Williamson & Masten, 1999). Transactions differ with respect to three critical dimensions: (1) their frequency of recursion; (2) the degree of uncertainty affecting them; and (3) the level and type of asset specificity involved in the supply of the good or service in question, which is of particular importance in TCE (Williamson, 1991; Williamson, 1996; Williamson, 2005). Within this study a transaction is considered as the transfer of agricultural goods and services, produced under stricter environmental, animal welfare and food safety legislation, from a farmer to society.

Transaction costs can be defined as costs that do not arise from the production process but are instead generated from the transfer of goods from one agent to another (Niehans, 1971). There are three main types of transaction costs: costs for searching for information before entering a transaction (*ex ante*); negotiation and bargaining costs; and costs related to monitoring and enforcement.

2.2. Why the EU legislates in the fields of the environment, animal welfare, food safety and animal health

From an economic perspective, environmental, food safety, animal health and animal welfare legislation is written to guarantee the provision of a series of "goods" at a publicly accepted level. Most of these goods are non-tradable and hard to privatize. At a private level, without legislation, there is no (or not enough) incentive to provide an appropriate amount of these goods. The resulting excesses and shortages are considered negative externalities since they have a potentially negative impact on parties not directly involved in agricultural production (van Huylenbroeck et al. 2007; Glebe 2007). Hence, the legislation is written to either guarantee a minimum provision, e.g. animal welfare, or a maximum provision, e.g. nitrate emission. Ideally the benefits- safe food,

environmentally- soundly produced, with a minimum of animal welfare- should be in balance with the costs incurred by the farmers. This way overall welfare is maximized.

One of the problems in establishing this balance is the assessment of the benefits (Vermeire et al. 2009). Most of the targeted public goods have intangible, multiple and/or complex benefits. This makes it very difficult to assess the aggregated benefits of this type of legislation. One way to partly overcome these difficulties is through monetary assessments which have the advantage of making aggregation of different types of benefits/effects possible. In addition, these aggregated benefits allow comparison to the costs, as well as comparison over different analyses (Johansson 1993). In the coming paragraphs we provide a literature review and some illustrative introductions on the three types of benefits of legislation.

2.2.1. Safety of the food chain and animal health

Food safety means avoiding human health problems related to food. Hence, the benefits of ensuring food safety arise by avoiding these problems, which are costs. We divide these costs in human health related costs and production related costs. Similarly, animal health legislation tries to prevent animal diseases, which may create huge costs for farmers and the society.

Purely private health benefits are reduced risks of suffering, pain, and a longer life (Traill et al. 2010). These are intangible and can be assessed through willingness-to-pay (WTP) studies. Revealed and/or stated consumer valuations of a reduced risk of illness or death are used to measure this WTP (Vermeire et al. 2009). Another approach is the Quality Adjusted Life Years (QALYs). Here a value is attributed to a normal healthy year. An increase in food safety has the potential to either increase the number of years of a person's life, or to maintain someone's health during a year. Attributing a value to this allows the benefit calculation of avoiding a foodborne health risk (Caswell, 2007; Traill et al. 2010).

Of course part of the costs related to health risks is also tangible as monetary costs: direct costs incurred by the patient and his family for transportation, the cost of getting care and out-of-pocket payments for hospitals and drugs. However, in many countries a (substantial) part of the costs are sustained by the public through health care schemes. Hence, they become public costs and avoiding them becomes a public benefit (Traill et al., 2010).

Indirect costs can be perceived through the same private/public perspective. The indirect costs are the productivity losses or forgone labour earnings. Illness and/or death reduce the contribution to the overall private or family productivity and the overall public or national productivity (GDP). At

the public level, the costs often increase because of the substitution of the monetary losses at a private level through unemployment schemes (Buzby et al., 2003).

On the other hand, these health related impacts have a potential impact on the food chain as well (Buzby et al., 2003; Atkinson, 2003). Due to the great importance of health related issues, a potential food safety threat can lead to what is called a food scare. These have short term and long term impacts on the food chain. The obvious short term effects are sharp declines in demand. For example, during the UK Bovine Spongiform Encephalopathy (BSE) crisis, the announcement of the possible link between Creutzfeldt-Jacob disease (CJD) and BSE resulted in an immediate 40% drop in domestic demand and a complete halt on beef exportation, a market worth 1,7 billion pounds per year (Lloyd et al., 2006)[3]. In addition, many farmers were obliged to get rid of their animal stocks. The UK government compensated part of the farmers' losses and implemented other crisis measures. This made public expenditure rise by 1.5 billion £ in 1996-1997, although other estimates have indicated 2 billion £ (Hansard 1997 in McDonald 1998).

Long term effects were the lingering decline in UK beef prices and lack of consumer trust. Two years after the start of the crisis, prices were still below the pre-crisis level (Atkinson 1999). Only ten years later, in 2006, export restrictions were completely lifted. The implementation of food safety schemes were and are a significant cost[4] as well.

The total economic losses due to the UK's BSE crisis, health and production- wise, were estimated at 3.7 billion, although others claim 10 billion $ worldwide (Jacob et al. 2000) or even 16 billion € (Beck et al. 2005). This exemplifies the potentially severe impact food safety and food scares have on production and health care costs.

An important side note must be made here. Although the consequences of food safety issues might be severe, the risks related to certain diseases are unevenly spread over regions and time. In the Netherlands, where risk is much lower compared to the UK, it was estimated that food risks of respectively 16.98 and 2.69 lost life-years occurred in 2002 and 2005 (using the QALY method described above), following the implementation of several precautionary measures. If this is compared to the estimated costs of the preventive measures, the outcomes are respectively 4.3 and 17.7 million € per life-year saved in 2002 and 2005. These are much higher values than used in cost-benefit analyses of drugs and medical interventions (Benedictus et al. 2009) and, since the risk

[3]This is no exception; also the Belgian dioxin crisis resulted in a halt in trade with over 30 countries (Buzby et al. 2003).

[4]Although other authors look at this as a benefit (Loader et al. 1996).

connected to BSE and CJD will only decline over time, the saved life-years, being the benefits of the preventive programs, will decline as well.

It can be therefore concluded that food safety risks can be severe. Thus the benefits of food safety measures are potentially high, although this depends strongly on the context.

The prevention of animal diseases through the implementation of animal health legislation creates significant benefits for the society. The costs of the Foot-and-Mouth outbreak in the UK in 2001 have been estimated in 8 billion £ (Webb, 2008). Next to the direct negative effects for farmers the costs of this huge outbreak are related to the reduction of animal trade and rural tourism. In general, the benefits of preventive actions with regards to animal diseases are considered to be significant for society. Reducing animal diseases is a global public good and this explains the long tradition of public involvement of infectious animal disease control (Hennesy, 2007).

2.2.2. Animal welfare

The benefits of animal welfare legislation are probably the most intangible of all three types of legislation. It is almost exclusively related to the field of ethics and moral values[5]. From an economic point of view, animal welfare is generally perceived anthropocentrically–even though attention is being given to the emotional well-being and welfare of farm animals (e.g. Désiré et al. 2002). Our vision of the animal's state is used to judge the animal's welfare, hence animal welfare is treated as a subset of human welfare (McInerney 2004, Lagerkvist et al. 2010). From this perspective, the benefits of animal welfare lie in our perception- in the utility we attribute to it.

Here as well, the concepts of public and private are applicable. According to McInerney (2004), what the broader society, the public, considers a minimum level of animal welfare, should be treated as a public good. Government policy should enforce a guaranteed provision of this lowest level, since all members of society would be affected by a violation and consider this a "cruelty". Higher standards of animal welfare that are only considered necessary by a minority should be treated as a private good which the government has no responsibility to provide. Although the treatment of animals at the minimum welfare level still causes negative externalities[6] to the group of people demanding a higher level of animal welfare, one can perceive the European situation through these

[5]Not exclusively related to ethics and moral values, it has for example indirect effects on food safety (Lagerkvist et al. 2010)

[6]Unintended effects on third parties.

public/private glasses. EU legislation on animal welfare guarantees a minimum provision, considered necessary by "all" EU citizens. Animal production systems with higher animal welfare standards are marketed on the private market and the consumer has to pay for his specific demands (for example free range eggs) (Veissier et al. 2008).

Table 2.1 – Grasp of consumer valuation studies on animal welfare.

Author	Method	Consumer benefit (WTP)	Animal treatment	Benefits > Costs
Bennett et al. 2003	contingent valuation	5.5 £	All AW demands	Not assessed
		0.9 £ /12 eggs	Cage ban (hens)	Yes
Bennett 1998	contingent valuation	0.43 £ / 12 eggs	Cage ban (hens)	Yes
Carlsson et al. 2007	choice experiment	10.84 SEK / 6 eggs	Legal cage ban (hens)	Not assessed
		8.4 SEK / 6 eggs	Voluntary WTP free range eggs (hens)	Not assessed
Liljenstolpe 2008	choice experiment	+ 19%	Mobile abattoir (pork)	Yes
		- 15%	No castration (pork)	No
		+ 32%	Outdoor pigs	Yes

Since we focus on EU legislation, the question is what does the public think about these minimum requirements? In other words does one attribute a benefit to them or not. Lagerkvist et al. (2010) performed a meta-analysis on Willingness-To-Pay (WTP) studies from the last two decades. They found that WTP is non-species specific, except for hens, where much attention is placed on housing conditions. On the other hand Ngapo et al. (2003) found that consumer preferences vary among countries, which complicates the generalization of WTP studies. Table 2.1 presents an illustrative series of (contextual) studies assessing existing or possible animal welfare legislation[7].

2.2.3. Environment

Agriculture is one of the major uses of land in Europe. It accounts for a substantial part of methane emissions (International Energy Agency 2013) and it is responsible for the bulk of nitrate use and water pollution. These are just some examples of why EU legislation intervenes in the agriculture-environment interaction. In times of significant environmental degradation and climate change, the motivation behind interventions regulating negative environmental externalities should be clear.
Due to the multitude of interactions, we will exemplify the benefits of environmental measures based on one measure, namely the nitrate directive. It is one of the first European directives aiming

[7]For more studies on WTP of animal welfare, see Lagerkvist et al. (2010)

to reduce pollution (European Commission 2010). Poor manure management and the resulting nitrate excesses in ground and surface water cause severe problems. Human health problems (Mahvi et al., 2005; van Grinsven et al., 2010) as well as eutrophication, acidification and ecosystem degradation (Carpenter et al., 1998; Camargo et al., 2006), are the most cited impacts of elevated nitrate concentrations.

The health related problems can be assessed in the same framework as food safety issues. They result in private tangible and intangible costs as well as public costs. For example, van Grinsven et al. (2010) assessed the health costs of exposure to nitrate polluted water in relation to colon cancer. Based on a study showing a correlation between long lasting, medium-level nitrate exposure among above medium level meat consumers, they conclude that, although uncertain, "current measures to prevent exceedance of 50 mg/L NO_3 are probably beneficial for society and that a stricter nitrate limit as well as other additional measures may be justified" (van Grinsven et al. 2010, p.1). They estimated a 3% increase of incidence of colon cancer in 11 member states due to nitrate exposure. Using the QALY approach (cf. Food Safety), this leads to a health related social welfare loss of 2.90 € pro capita or 0.70 € per kg of nitrate leached.

Other studies used consumer WTP to analyse the benefits of nitrate reduction in drinking water. These studies can take into account health related consumer valuation and/or environmental valuation[8]. As with animal welfare, the results of WTP studies are very contextual (e.g. Stenger et al. 1998).

- A contingent valuation study found a WTP of 12.97 £/year, per household for water supplies below the 50 mg/l limit set by the Nitrate Directive (Hanley 1991).
- Edwards (1998) found a WTP of 1650 $/household for a nitrate concentration as low as 10 mg/l in a local aquifer (used for drinking water).
- Frykblom (1998) assessed the consumer valuation of reduced eutrophication in the Laholm Bay. He found an annual WTP of 747 SEK per person.

Another way to assess the cost of environmental pollution is through the assessment of mitigation and abatement costs. There are many ways to do so, ranging from on-farm management practices to water purification. However, these assessment techniques are criticized for not incorporating real social costs. An example of this problem? If we assume an effective implementation of the nitrate

[8]Depending on the study and the information provided, the emphasis may lie on one of each.

directive, the implementation cost of this policy can be considered the cost of environmental pollution. In this example, the costs always equal the benefits; hence there is never a welfare loss or gain[9].

An approach that is more targeted towards the real costs of environmental (nitrate) pollution is the calculation of costs on affected industries. A Swedish study by Silvander et al. (1991) found that eutrophication results in a loss of 65 million SEK for commercial fisheries and 41 million SEK for aquaculture.

A similar conclusion can be drawn here for food safety; the impacts of nitrate pollution can be severe, which justifies the abatement.

To sum up, the benefits of animal welfare, food safety and environmental legislation are diverse and their assessment is not straightforward. However, a series of studies showed the legislation's clear benefits, mainly through the assessment of avoided costs. In some cases, these assessments allow policy makers to draw conclusions (e.g. Liljenstolpe 2008, Benedictus et al. 2009), sometimes even if only one of the multiple benefits is taken into account (e.g. van Grinsven et al. 2010). More assessments are only a first step and further analyses have to be taken to draw valid conclusions.

2.3. How EU legislation is transposed into the legislation of Member States (general principles) and implications for comparing costs of compliance

The main goal of the European Union is the progressive integration of Member States' economic and political systems and the establishment of a single market based on the free movement of goods, people, money and services. To this end, Member States cede part of their sovereignty under the Treaty on the Functioning of the European Union[10], which empowers EU institutions to adopt laws. These laws take precedence over national law and are binding for national authorities. The Treaty (article 288) makes provisions for five forms of legal instruments, each with a different effect on the Member States' legal systems. Some are directly applicable in place of national legislation, while others permit the adjustment of that legislation to the European legislation.

[9] If not compared to other mitigation strategies.

[10] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:0047:0200:EN:PDF

Regulations are the most direct form of EU law. They have a general scope, are binding in all their elements and directly applicable in each Member State. Just like a national law, they give rise to rights and obligations directly applicable to the citizens. National governments do not have to take action themselves to implement EU regulations.

The **Directives** bind Member States with regards to the result to be achieved, while allowing the national authorities competency as to the form and methods used to achieve this result. Directives are used to bring different national laws into line with each other. They define the objectives to be attained by a common policy and leave it to the Member States to choose the forms and instruments necessary for complying with it. Since the Member States are bound by the objectives laid down in directives, they have some discretion, in transposing them into national law, taking into account special national circumstances. Directives take effect by virtue of being notified to the Member States to which they are addressed, which are obliged to adopt the national measures necessary for implementation of the Directive within the time limits set by it.

The other binding legal instruments are the **Decisions**, which only apply to specific cases, involving particular authorities or individuals.

Another means of reaching the common-policy objectives of are non-binding concerted actions in the form of coordination of national policies, mechanisms for exchanging information, bodies for cooperation, European programmes and/or financial support. Therefore, in addition to the above binding acts, which form European law, the Council and the Commission can adopt Recommendations which suggest a certain line of conduct or outline the goals of a common policy and give opinions after assessing a current situation or certain facts in the Union or the Member States.

Furthermore, the Council and the European Parliament adopt Resolutions, which are also not binding, suggesting a political desire to act in a given area. These instruments enable the European institutions to suggest guidelines for coordination of national legislations or administrative practices in a non-binding manner, i.e. without any legal obligations for the addressees - Member States and/or citizens.

As outlined above, in order to fulfil their obligations, Member States are required to transpose the directives, including those in the field of the environment, food safety and animal welfare into national law. In doing so, they may take into account specific national and local features- adapting the regulation, for instance, to the actual status of the environment, the soil and climatic conditions while taking into consideration socio-economic conditions as well.

This translates into differences in the way Member States transpose the legal obligations into their national laws and in differences in actual obligations for the operators/citizens concerned. This, in turn, may have an impact on costs borne by individuals. In fact, such differences may be justified by objective criteria, but, to a certain extent, they may also be driven by socio-economic considerations.

The differences in the approaches taken in transposition and their possible impact on costs may be analysed, for instance with reference to the Nitrate Directive whose, aim is to protect water from nitrate pollution from agricultural sources.

This Directive imposes the obligation on Member States to designate "Nitrate Vulnerable Zones"(NVZs) - areas of land which drain into polluted waters or waters at risk of pollution and which contribute to nitrate pollution. In the designated nitrate vulnerable zones, Member States shall set up action programs, including a set of measures obligatory for farmers in such areas. Those measures concern, for instance, minimum storage capacity, prohibited periods for fertiliser application, balanced fertilization including the limit of 170 kg manure N per hectare per year.

The percentage of territory designated as nitrate vulnerable zones in Member States[11] ranges from 1.2% of the national territory (Poland) to 67.8% (Belgium), with percentages of designated vulnerable zones exceeding 35% of the national territory in Bulgaria, Hungary, France, Czech Republic and the United Kingdom.

Based on article 3 of the Nitrate Directive, Member States can also choose to apply measures to the whole territory instead of designating NVZs. In the EU, Austria, Denmark, Finland, Germany, Ireland, Lithuania, Luxembourg, Malta, the Netherlands and Slovenia have decided to implement an action programme over their whole territory, establishing the same level of protection and equal obligations for all farmers. This approach may be based on a political choice to set out the same rules for all farmers, thus facilitating implementation and inspections as well as establishing a homogeneous approach to water protection across the country.

The approach taken by the competent Authorities in the designation of Nitrate Vulnerable Zones determines the number of farmers concerned by compulsory measures.

It must be highlighted, however, that the absence of designation does not always imply the absence of limitations on farmers outside the designated areas. Member States are always allowed to

[11]http://ec.europa.eu/environment/water/water-nitrates/pdf/sec_2011_913.pdf

establish measures to protect the environment. As shown in this study for instance, in certain cases the competent authorities have established general provisions to protect water in agricultural practices outside Nitrate Vulnerable Zones as well, even if they are normally less strict. The Italian regulation on livestock manure utilization, applicable to the whole national territory, for instance, includes an obligation to maintain 5 m or 10 m of unfertilised buffer strips when applying solid manure and slurry; a ban on utilisation of manure on water saturated, snow covered and frozen soil; obligations for minimum storage capacity of solid manure on a sealed platform corresponding to manure production of 90 days; obligations on minimum slurry storage capacity of 90-120 days depending on livestock category and crop rotation; obligation on notification of manure spreading on land and a requirement to prepare a fertilization plan for farms over a certain size. Such obligations also imply costs for farmers.

With reference to the action program, Annex of the Nitrate Directive defines the minimum set of measures, including inter alia:

- periods when the application of certain types of fertilizer to the land is prohibited;
- the capacity of storage vessels for livestock manure exceeding that required for storage throughout the longest period during which land application in the vulnerable zone is prohibited;
- the limitation of the "amount of livestock manure applied to the land each year, including that deposited by the animals themselves" to 170 kg nitrogen (N) per hectare per year.

The required slurry storage capacity set out by Member States in Central Europe, spans from 9 months in Denmark, to 7 months in the Netherlands, 6 months in Germany, Poland and Austria, and 16 to 22 weeks in Ireland. These differences could be justified on the basis of variations in climatic and soil conditions, soil cover and crop rotations: lower storage capacity is required on grassland farms and in relatively mild climatic conditions which allow for a long growing season.

A long growing season also justifies reduced required slurry storage capacity in southern European countries. In Italy, for instance the requirement is 90 to 180 days for cattle slurry, depending on the area of the country and soil cover (grassland or other crops) and 150 to 180 days for the other livestock categories.

Regarding the limitation of nitrogen applied with livestock manure, the Directive establishes the maximum limit of 170 kg per hectare per year. This is a precise figure, which allows for no flexibility. It is transposed as such in the action programs and establishes an obligation on farmers. It is normally applicable, for practical reasons, as an obligation at farm level (not at parcel level)

even if in some cases (for instance the case of the action programs in England and Wales) a limitation at parcel level is also applicable. However, the number of livestock units, which could be kept on the farm based on such a limit depends on the nitrogen standards (nitrogen excretion per livestock head per year or per round) set out in the action program. For instance, in the case of dairy cattle, N excretion may range from 133 kg per head per year in the Danish action program, to 120 kg per head per year in the Dutch action program, to 85 kg/head per year in France, Italy and Ireland. These differences may be explained, at least partially, by factors such as average milk production and diet (for instance based on maize or on grassland) and by cattle breeds. This variation of nitrogen excretion figures translates in different livestock densities per hectare of land.

Some action programs (for instance that of Belgium's Flanders region, of Germany, and of the Netherlands) have established different nitrogen excretion standards for pigs and poultry to account for low nitrogen diets. Accordingly, farmers implementing such practices are allowed to increase the number of livestock per hectare corresponding to 170 kg N.

The Directive allows for derogation of the limit of 170 kg/ha per year from livestock manure under specific conditions: the Commission may grant derogation from this requirement on the basis of objective criteria, provided that the general objective of the Directive is not prejudiced. Examples of objective criteria are long growing seasons, crops with high nitrogen uptake, high net precipitation in the vulnerable zone and soils with exceptionally high denitrification capacity.

Derogation is granted by a Commission decision, following a positive ruling from the Nitrates Committee. Eight countries have obtained derogations up to October 2013: Austria (expired at the end of 2007), Belgium (two Commission decisions, for Flanders and Wallonia), Ireland, Germany, Denmark, the Netherlands, the United Kingdom (two Commission decisions for England, Scotland and Wales, and Northern Ireland) and Italy (for the regions of Piedmont, Lombardy, Emilia-Romagna and Veneto).

All these provisions relate to the compliance with the limit of 170 kg N per hectare per year from livestock manure and influence the amount of manure which can be managed within the farm and consequently the amount of manure to be treated or transported outside the farm. As such, this may have an impact on the cost of compliance.

From this overview and the example dedicated to the Nitrate Directive, it becomes clear that there can be substantial differences in the costs of compliance with a Directive as they can be transposed differently into national legislation. For the EU, it is important that the Member States achieve the objectives of a Directive, but the EU allows flexibility in its national implementation, allowing for differences in climatic, soil and structural conditions of farms.

2.4. Costs and benefits of complying with mandatory regulations in the fields of environment, animal welfare, food safety and animal health

Implementing the legislation on the environment, animal welfare, and food safety does not only entail additional costs, but can also generate benefits. Table 2.2 gives an overview of all the costs and benefits potentially deriving from the implementation of such regulations. Thereafter, the cost categories will be described separately, followed by the benefits in a subsequent section.

Table 2.2 – Costs and benefits of compliance with legislation on environment, animal welfare food safety and animal health

Costs for farmers	Benefits for farmers
Operational costs (including inputs and labour costs)	Savings in inputs/ labour
Investments / Disinvestments	Investment support
Foregone production and profits (opportunity cost)	Additional revenues
Private transaction costs (including administrative costs)	Subsidies Extension/education programmes financed with public funds

Based on Mettepenningen et al., 2009

2.4.1. Costs

The main aim of this section is to review the literature study performed by Brouwer *et al.* (2011), which provides an excellent overview of the available research on costs resulting from EU legislation on the environment, animal welfare, and food safety.

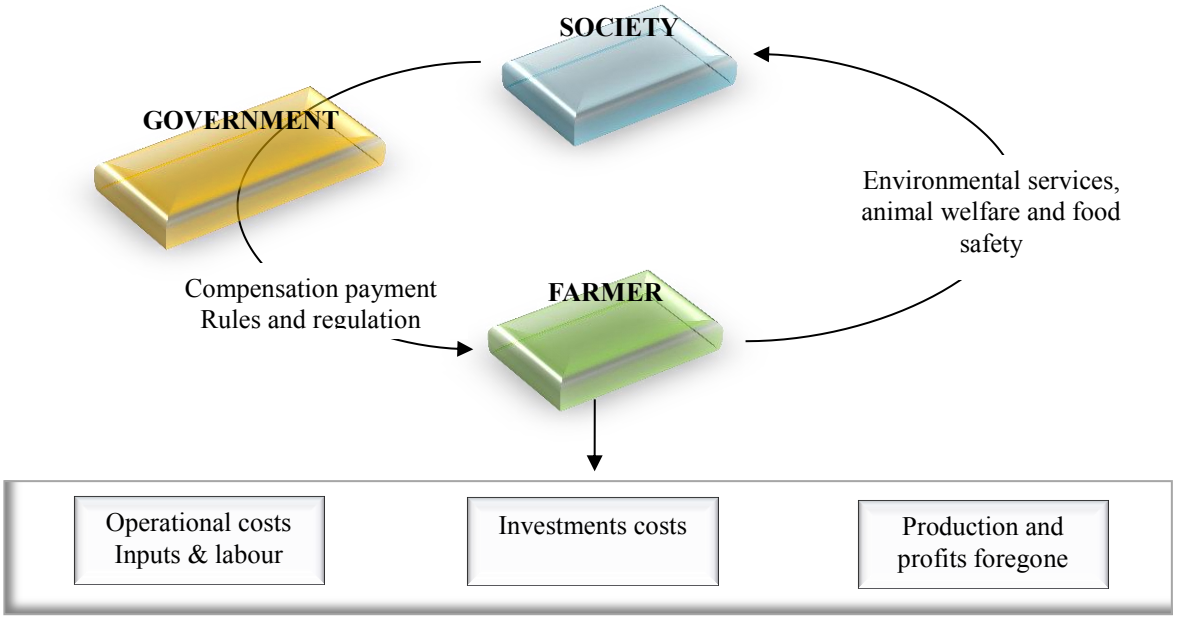
An overview is provided in Figure 2.1 of the main cost factors to be taken into consideration, from the perspective of farm management. Analysing the figure, it comes to light that **operational costs** constitute a first important cost category. These costs refer to activities such as manure processing, sowing grass buffer strips, assets maintenance, and the application of ear tags.

Another important cost category are the **investment costs**, e.g. investments in a mechanical weeder, or in the purchase of a new milk tank, as well as costs deriving from disinvestments. For instance disinvestments result from regulations preventing the further use of a certain machine.

Other relevant categories are the **costs for foregone production and profits** (often referred to as opportunity costs), following compliance with the standards set by legislation. Such norms might also entail **transaction costs** (often referred to as private transaction costs), which are generated

through information gathering on legislation, the decision-making process, negotiation with officials, provision of information for monitoring procedures, and coordination with other farm activities. Therefore, private transaction costs are mainly related to the administrative procedures that go along with the legislation.

Figure 2.1 – Main cost factors of compliance with legislation on the environment, animal welfare, and food safety.



Based on Brouwer et al. (2011)

Along with these cost components, it is important to also take into account the differences between:

- costs in the short and long term, since costs that might be high in the short run may go down in the long run (e.g. costs sustained in order to prevent soil erosion can increase production and profits in the long run);
- direct and indirect costs: here we refer to the previously discussed distinction between costs sustained directly by a farmer, or indirectly imposed by another company operating in a different stage of the supply chain;
- fixed and variable costs.

The table represented in the following page is again based on the literature review by Brouwer *et al.* (2011), and is intended to offer an overview of examples of cost components that are generally included in research about farm level compliance with EU legislation in the fields of the environment, animal welfare, and food safety.

Table 2.3 – Examples of components in compliance with EU legislation on environment, animal welfare, and food safety.

EU legislation	Operational costs	Investments	Foregone profits	Transaction costs	Sources
Environment					
Nitrate Directive (91/676/EEC)	- storage, spreading and processing of manure	- storage, spreading and processing of manure	- reduction in yield or quality	- record keeping and other administrative burdens	Daatselaar *et al.*, 2010; Entec, 2008; Jacobsen, 2004; Picazo-Tadeo and Reig-Martinez, 2007; Uthes *et al.*, 2010; van der Straeten *et al.*, 2010; Vukina and Wossink, 2000
	- feed changes		- reduced stocking rates		
	- cost of cover crops				
Integrated pollution prevention and control (IPPC) Directive (2008/1/EC)	- animal feeding changes	- fuel storage changes		- permit costs	
	- manure and slurry spreading	- animal housing design and equipment		- training and record keeping	Ryan, 2006
		- manure storage covers			
National Emissions Ceiling (NEC) Directive (2001/81/EC)		- altering housing needs			van Horne *et al.*, 2006
Good Agricultural and Environmental Conditions: Preventing erosion	- producing gullies				Jongeneel *et al.*, 2007
Good Agricultural and Environmental Conditions: Providing minimum maintenance levels for non-productive areas	- seed and manure purchase				Jongeneel *et al.*, 2007
	- spreading and sowing				
	- vegetation shredding				
	- ploughing of fire barriers				
	- costs for terraces				
Animal welfare					
Group housing of sows, by 1st January 2013 (from Directive 2008/120/EC)		- disinvestments of current equipment			Gourmelen *et al.*, 2004; Baltussen *et al.*, 2010
		- re-investments for group housing			
	- veterinarian services		- effects on meat prices		de Roest *et al.*, 2009; Valeeva *et al.*, 2010
	- anaesthetic & analgesic agents		- effects on slaughter yield		
	- additional labour demand				
	- effect on feed prices				
	- costs of adaptations in farm management (like air temperature, cleanliness of pens, stocking rate, sex grouping)				
Food safety					
Hygiene of foodstuffs and feed (2003/99/EC, 2160/2003, 183/2005,	- monitoring for Salmonella	- fencing	- eradication of infected flocks	- administration costs	Fearne & Walters, 2004; Kangas *et al.*, 2007; King *et al.*,

EU legislation	Operational costs	Investments	Foregone profits	Transaction costs	Sources
178/2002, 9/362/EEC, 92/46/EEC)					2007; Kiss & Weingarten, 2003, LKS, 2009, van Wagenberg *et al.*, 2004
	- costs for Salmonella control measures	- disinfectant storage	- penalty to slaughter plant	- inspection costs	
	- costs for testing for Salmonella	- modifications to buildings/ new buildings	- expected foregone revenue for eggs	- costs for advice	
	- Salmonella vaccination costs	- animal handling equipment		- record keeping	
		- feed mixers			
		- new milking equipment			
		- new cooling equipment			
Identification and registration of animals (21/2004, 1760/2000, 2008/71/EC)	- tags/ transponders (+cost of lost ones)	- tag applying devices		- communication/ reporting to government	Bezlepkina *et al.*, 2008, Chotteau *et al.*, 2009, Ipema *et al.*, 2003, Saa *et al.*, 2005
	- labour costs for identification and registration	- reading equipment			
	- maintenance of identification equipment	- identification portals			
		- equipment to report to government			

Based on Brouwer et al. (2011)

2.4.2. Benefits

The literature study by Brouwer *et al.* (2011) lists also a series of relevant benefits. The positive implications of compliance with environmental, animal welfare, and food safety standards are explored, distinguishing the perspectives of farmers and of consumers.

2.4.2.1. Benefits to farmers

Several benefits have emerged for farmers who comply with the mandatory regulations related to the environment, animal welfare, and food safety of which Table 2.3 provides an overview.

One substantial advantage of compliance comes in the form of **subsidies** or investment support associated with specific measures. These subsidies create an economic incentive towards compliance itself, especially in the case of voluntary measures. They are also used to compensate farmers for the extra costs farmers may bear with respect to special requirements for food safety or animal welfare (Bennett, 1997, Esturo *et al.*, 2010). They can have a relevant impact when the legislation demands an important system change on farms.

Furthermore, the existing institutional environment can **reduce the transaction costs** of a new policy. Aligning the policy with existing institutional arrangements may influence not only public transaction costs, but also information collection related to transaction costs sustained by private parties (Coggan *et al.*, 2010). Consequently, a reduction of search costs can be experienced, i.e. as a result of extension services.

Savings can take place at the operational level as well, e.g. in fertilizer or pesticide costs. Progress in animal nutrition, reproduction, quantitative genetics, and the development of molecular genetics, proteomics, and functional genomics, are examples of opportunities that can open new perspectives for the agricultural sector with a considerable impact on the economics of meat production and processing (Garnier *et al.*, 2003). Therefore, it can be argued that, by implementing innovations, farmers can ensure a high level of food safety while reducing production costs. The optimal solution would be to enable cost-effective mandatory measures at farm level which are aimed at reducing operational costs.

Legislation can create a higher awareness among farmers about the value of nutrients in animal manure. This circumstance creates the opportunity for farmers to save mineral fertilisers. Complying with animal welfare legislation generates better conditions for animals, that may raise their productive performances and may reduce veterinary and medicines costs.

Moreover, efforts towards the improvement of the environment, animal welfare, and food safety – in light of the recent evolutions in consumer demand – can result in a higher price for agricultural products. This can generate **extra revenues**, especially when direct marketing systems are established.

As far as **animal welfare is concerned**, literature shows that when society values farm animals beyond the value they possess based on productivity, a trade-off exists between competing levels of animal welfare, and productivity values (Lagerkvist *et al.*, 2011). Moreover, in some cases, production economics reveal that producers will not maximize animal well-being, even if the latter is highly correlated with output (Lusk and Norwood, 2011). The current study will show whether the benefits to farmers can outweigh their costs in relation to actions directed at improving animal welfare.

2.4.2.2. Benefits to Citizens

As far as benefits are concerned, complying with mandatory regulations in the fields of the environment, animal welfare, and food safety, agriculture is fulfilling one of society's demands, as demonstrated in this section.

The EU has implemented important legislation to improve the quality of the environment. The costs of not implementing this legislation provides an indication of the benefits for society. 12 Findings show that the environmental and health benefits of air pollution prevention have been estimated in several billion € (DG ENV, 2011). The benefits of reaching full, future compliance with legislation concerning improvements in water quality are within a range of 5 up to 20 billion €. Agriculture certainly contributes significantly to these benefits.

Literature provides information as to what the public demands from agriculture are (Hall *et al.*, 2004, Hellerstein *et al.*, 2002). Hall et al. (2004) argue that value is placed on the farmers in their role as providers of **environmental goods and services**, as well as on their cultural heritage. Hellerstein *et al.* (2002), investigated public agricultural demands indirectly, by looking at the objectives specified in State legislation aimed at protecting farmland. They found that, although environmental management can also be undertaken by actors other than farmers, legislation still ensures farmers an important role. The authors argue that the interest of other actors in the rural area for environmental management suggests that society is emotionally attached to agriculture. More recently, Zasada (2011) presented a review of societal demands towards agriculture in peri-urban areas, noticing that farmers' contribution to the environment and to the landscape is particularly highly valued. However, the modern trends of scale-enlargement and specialisation that characterize the agricultural sector are not favoured by urban populations, who prefer a landscape with small-scaled and heterogeneous structures, together with natural features. Therefore, compliance with environmental requirements for landscape development that incorporate public preferences can lead to substantial benefits to society. These benefits can also be translated into private benefits when considering urban dwellers' interest in spending time and money in rural enterprises.

Moreover, increasing pressure is being placed on agriculture to improve its sustainability by adopting environmentally-friendly practices due to the visible consequences of climate change, air and water pollution, and biodiversity erosion, (Givens and Jorgenson, 2011). With increasing urbanisation, the value attributed to agricultural contributions to the environment may increase,

[12]For details see „The costs of not implementing the environmental acquis" DG Environment, COWI, ECORYS, Cambridge Econometrics, EU Study ENV.G.1/FRAU/2006/0073

since people who have grown up in urban areas tend to exhibit higher levels of environmental concern (Czap and Czap, 2010).

In Europe, legislation issued by national governments has historically been the main protector **of farm animal welfare** (Bennett, 1997). Consumer concerns regarding animal welfare have already been manifested over the past decades. Events triggering this attitude were the negative implications of intensified animal farming methods on animal welfare, as well as interconnections with sustainability issues (Vermeir and Verbeke, 2006; Broom, 1991). Such public concerns stress the need for animal welfare standards and legislation, and contributes to determining their scope. Research by Vanhonacker et al. (2008) has furthermore shown that the notion of animal welfare might differ significantly between citizens and farmers. In fact, citizens primarily consider animal welfare in terms of affective states or natural living rather than as biological functioning. Therefore, maximising the benefits of animal welfare regulations for society requires the conceptualisation of the notion. This concept can then be used as a framework and a tool to tailor transparent and understandable information campaigns about the efforts, actions, and policies undertaken to improve farm animal welfare. Multiple benefits can thus be achieved, including a balanced trade-off between consumers' demand for animal welfare and the costs producers sustain fulfil legal requirements (Lagerkvist *et al.*, 2011).

Compliance with regulations at farm level is certainly beneficial to citizens with regards to **food safety**. Food safety is considered as a non-negotiable food quality aspect: European consumers expect every food to be safe for human consumption (van Wezemael et al., 2010). Reduction in consumer health risks is usually the primary benefit of food safety policies. As such, safe food is considered a condition *sine qua non* of consumers' acceptance of food products. The unconditional nature of the matter implies that any safety-related incident can have far-reaching effects on the food industry (Grunert, 2005). Since food safety is a typical credence product characteristic (which cannot be, observed either at the moment of purchase or at consumption), trust in food chain operators as well as in public regulations and standards is required. Recent food scares, new production and processing technologies, and a declining trust in science and scientific institutions, are believed to be the chief contributors to the declining level of trust in the safety of commercialised foodstuffs in Europe (Niva and Makala, 2007). On the one hand, the technical aspects of production and processing technologies might be difficult to understand for non-specialists. On the other hand, consumers have developed preferences for specific practices, i.e.

"natural" and organic farming methods, while disliking others, i.e. genetic modification and "excessive processing" (see da Costa *et al.*, 2000, de Barcellos *et al.*, 2010, Nielsen *et al.*, 2009).
Finally, as the external competitiveness of EU agriculture is concerned, the legislation in the field of environment, animal welfare and food safety undoubtedly has, unlike the costs of compliance, contributed to further strengthen the position of EU food products on the world market. The higher priced EU products incorporate a high reliability in terms of food safety, which is strongly appreciated by the importing Third Countries. Compliance with high standards of animal welfare and environment is promoted by the EU authorities to enlarge access to the world market.

2.5. Impact of compliance with mandatory regulations on environment, animal welfare food safety and animal health on agricultural competitiveness

All factors described in the previous sections lead to different cost patterns for farmers both within and outside the implemented EU legislation on the environment, animal welfare, and food safety. These regulations can constrain strategic management, especially since the agricultural sector is subject to frequent regulatory change (Henson and Caswell, 1999). The existence of EU regulations may thus lead to disadvantages for EU farmers. At the same time, capture theory suggests that farms may attempt to co-opt the regulatory process, in an attempt to gain strategic advantage (Henson and Caswell, 1999). This can entail advantages for some farmers which affect competitiveness.

2.5.1. Competitive disadvantage of EU farmers

According to economic theory, any regulation that raises the cost of production will have a negative impact on net exporters, in this case, of agricultural commodities. Compared to regions or sectors with different regulations, the existence of compliance costs can reduce the overall competitiveness of a sector over less regulated sectors or regions (Rugman *et al.*, 1997). The magnitude of the bias will be determined by both the level of the costs created by the regulation, depending on whether competitor countries also impose similar regulations, and the competitive advantage of the country on the international marketplace for the regulated product (Tobey, 1991).

As far as **environmental regulations** are concerned, some authors (i.e. Brouwer *et al.*, 2000) believe that the negative trade impact of environmental regulations in developed countries will be limited. Cassels and Meister (2001) identify three reasons for this phenomenon:

1. most competing exporters among the developed nations have similar agro-environmental schemes and regulations;
2. developing countries, whose environmental standards are usually less stringent, do not have a major share in the global export market of most agricultural goods;
3. any effect on competitiveness is likely to be overshadowed by more significant forces such as movements in exchange rates, shifts in consumer demand, differences in labour costs, health and safety standards or trade policies.

However, other authors believe that environmental regulations will affect agricultural production and the trade balance (Komen and Peerlings, 1998). In conclusion, the impact will depend on a number of factors, namely: the type of commodity, the position of the producer on the world market, the impact on costs of the regulation relative to total production costs and the regulations operating in the most important competing countries.

2.5.2. Competitive advantage of EU farmers

Within the EU, the efficiency of the solutions selected to conform to the obligations imposed by laws can potentially impact competitiveness. This occurs both at farm- and sector-level and may also create differences amongst regions. Henson and Casswell (1999) describe these effects with respect to food safety regulations, and how the latter can be strategically beneficial for farms and firms. Costs will differ according to efficiency in compliance and depending on firm size, existing standards of operation, and cost structure.

A second type of benefit is linked to trends in consumer demand. The focus of consumers in agricultural and food markets can shift from price-based to **quality-based competition**. This creates a competitive advantage for those producers who are already dealing with issues like environmental protection, animal welfare, and food safety. Consumers increasingly assess product quality on a broad array of attributes. These encompass animal welfare, pesticide use, or environmental impact (Henson and Reardon, 2005), Consumers are, in some cases, even willing to pay a higher price for products that positively comply with these attributes (Vanhonacker and Verbeke, 2009).

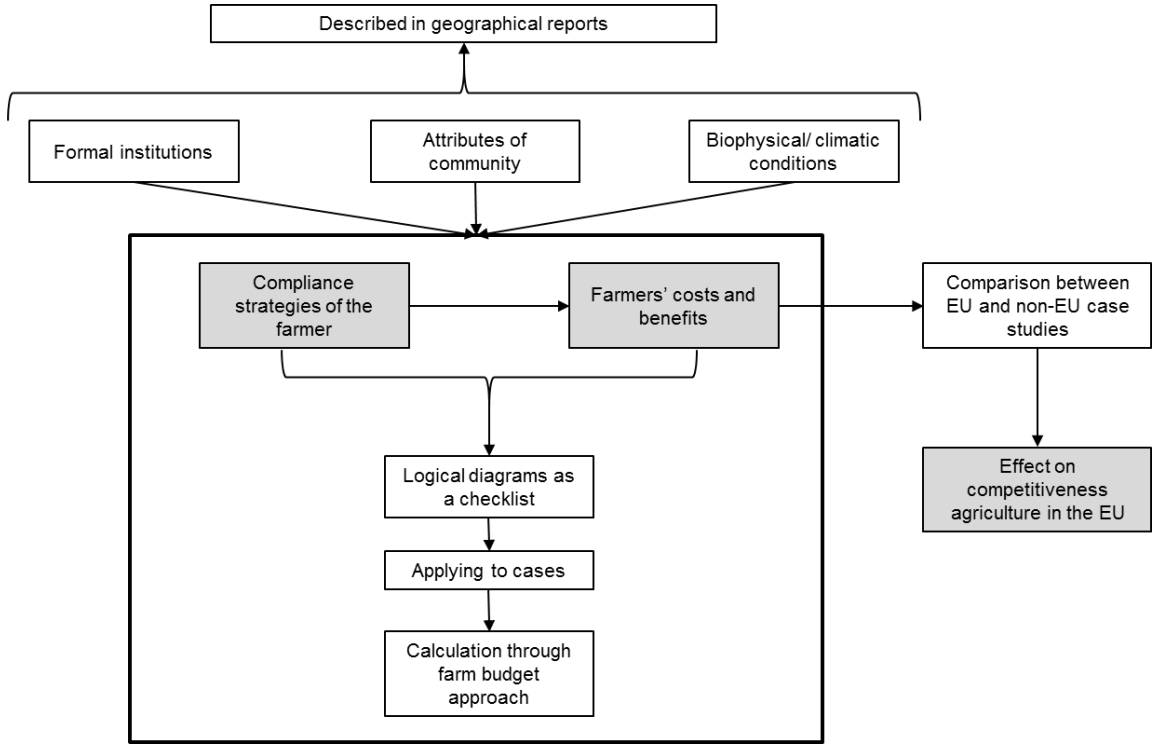
Food safety regulations are thus an example of how compliance with standards is beneficial to producers in the agricultural sector, providing incentives and creating opportunities for well-

managed and market-oriented firms. Moreover, these issues require rapid reactions. Firms that act quickly to assure consumers that their products meet any new requirement entirely will achieve a competitive advantage over those rivals (Loader and Hobbs, 1999), who might not have been restrained by similar rules.

2.6. Analytical framework

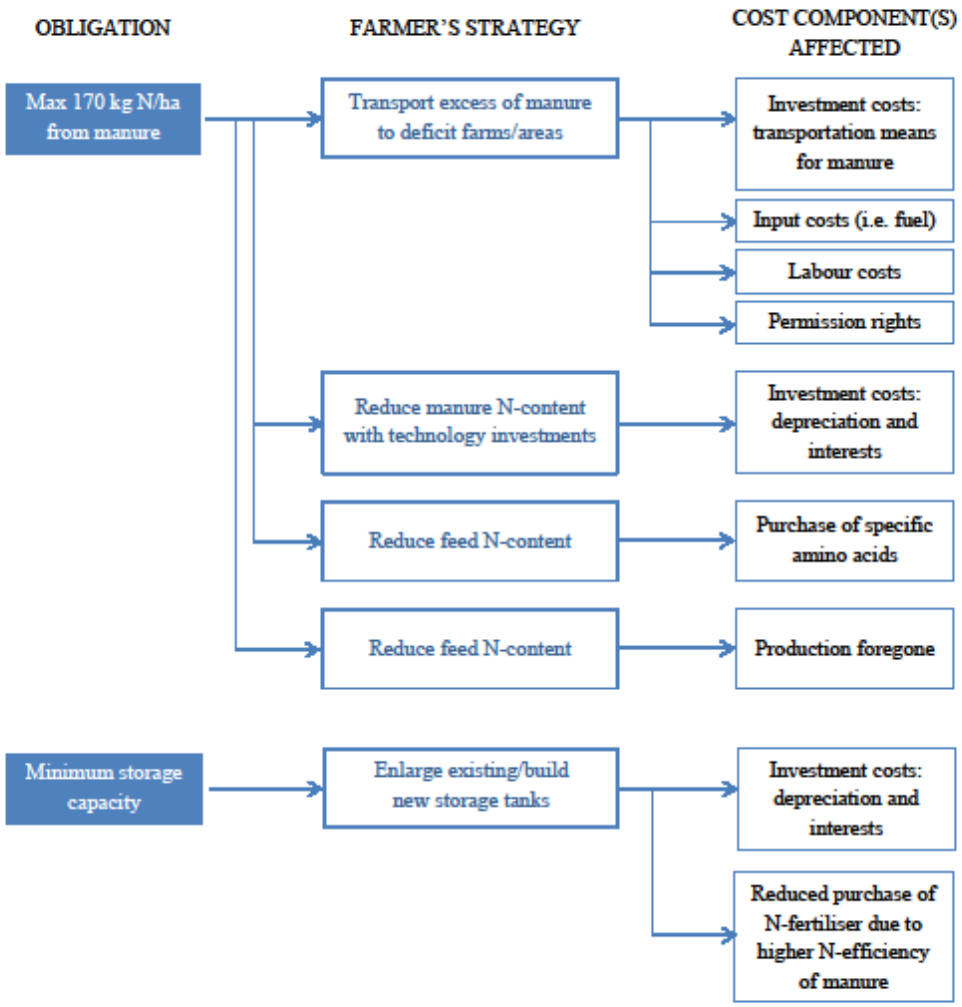
Based on the information provided in the previous sections, a framework can now be constructed that details the approach of this study to the analysis of the effects of EU legislation in the fields of the environment, animal welfare and food safety. This framework will look at both the compliance costs for farm businesses and at the competitiveness of the agricultural sector of the EU. As shown in the figure below, the main focus of the project is to estimate of the costs and benefits at farm level, which result from the strategies selected by each individual farmer when complying with the relevant regulations. These strategies will be outlined for different case studies located in both the EU and Third Countries, and corresponding logical diagrams will be elaborated and used as a checklist. Their purpose is to clarify the minimum limits that policies specify, to link these obligations to possible compliance strategies, and to list the costs and benefits that the latter create. A farm budget approach will be used to calculate costs and benefits. As seen in the previous sections, many factors influence compliance strategies, as well as their costs and benefits such as formal institutions, community attributes, and the biophysical/climatic conditions. This report does not list these features in detail. The information contained in the geographical reports allows for a better understanding of the observed cost-benefit patterns.

Figure 2.2 – Analytical framework.



The definition of both farmer strategies and compliance costs is based on the detailed, individual analysis of each piece of legislation and presented by means of logical diagrams (figure 2.3). The Nitrate Directive (Directive 91/676/EEC) is here acknowledged as an example of such a process. The Directive aims at protecting surface and ground-water by preventing pollution from nitrates originated by agricultural sources through the adoption of good agricultural practices (GAPs). Besides, the norm defines specific territories as Nitrate Vulnerable Zones (NVZs). When farmland is located within such a zone, the farmer must comply with the NVZ action programme measures. These measures impose a limit to the use of N to 170 kg/ha/year, and prohibit the use of any chemical fertiliser or manure during autumn and winter. For this reason, a minimum storage capacity for manure of 180 days should be available. Therefore, careful calculation is required of the amount of N applied on-field, taking into account crop requirements, soil N-supply, manure N-supply, weather conditions, etc. The farmer must also keep farm and field records on cropping, livestock numbers, N-fertiliser and manure use. The figure shows the logical diagram constructed for the Nitrate Directive. Note the obligations stemming from the legislation and how these are strongly connected with farm management strategies, and ultimately the resulting cost components and benefits.

Figure 2.3 – Logical diagram of the Nitrate Directive



Farm management strategies and their relative costs and benefits are influenced by a number of factors. Formal institutions determine how the Directive is transposed into national law (e.g. whether the country/region will apply for a derogation), how the monitoring system is organized (the frequency of inspections, the magnitude of penalties and fines) and the organisation of extension services to help farmers with compliance. Furthermore, influence is also exerted by characteristics which distinguish the individual farmer and his farm. More educated farmers might have lower compliance costs, as would farmers with more experience, a better professional network and more extensive livestock systems. Climatic and biophysical conditions, like the amount of rainfall or the soil type, will also affect the amount of N that can be applied to soils. All these aspects have to be taken into account in determining the costs and benefits related to the implementation of the Nitrate Directive.

3. Methodology

This chapter outlines the methods employed to accomplish the objectives defined in Chapter 1, and answer the research questions described in Chapter 2. The following section explains the features of the typical farm approach used in this study, the procedure selected to assess the cost of compliance at the farm level, and the designated cost items.

3.1. The typical farm approach

We used the typical farm approach. A typical farm is a model farm representing the most common farm type for a specific product in a specific country or region. The necessary technical and economic data to define a typical farm are collected by farmers and local experts. The typical farms are fully comparable worldwide as the same standard rules are used. Still, the number of typical farms does not allow statistically significant conclusions. The typical farm is a tool used to estimate the total cost of production per unit (i.e. euro/kg of milk, euro/ton wheat etc.).

Due to the lack of a worldwide farm accountancy system, this is the only approach available for a comparison of production and compliance costs across the eight product sectors with a commonly defined methodology. The typical farms are fully comparable worldwide due to standard rules. Still, even with a high number of typical farms it is not possible to draw statistically significant conclusions.

The approach was developed in various contexts, differentiated by industry: the International Farm Comparison Network (IFCN), for dairy farms; the *agri-benchmark* networks, for beef and sheep, cereals, fruits and vegetables, and wine; the Interpig network for pig meat; and the International Poultry Production (IPP) cost analysis performed by the Wageningen University and Research Centre. Two clusters can be identified in terms of methodological approach: on the one hand, the IFCN and *agri-benchmark* networks, on the other hand the Interpig and IPP networks. In the description of the methodology, the differences will be highlighted.

3.1.1. General structure of the approach

The IFCN and *agri-benchmark* networks are composed of country experts, who work in association with focus groups composed of local experts (so-called panel groups), according to a shared methodology. The major objective of these networks is to generate independent, worldwide knowledge on the costs of production and of revenues at farm-level. In order to achieve such

knowledge the central research centres, IFCN Dairy Research Centre, the Thünen Institute, AHDB and WUR-DLO, have developed a reference methodology for the calculation of production costs, which has been adopted for this study. The methodology details the steps which need to be taken by the national experts consulted when defining a typical farm.

3.1.2. Selection of regions and locations

The first stage of the typical farm approach is the selection of the geographical areas where the typical farms are located. This step is carried out by the national experts using national statistics. Before establishing a typical farm, the experts have to understand the spatial distribution of the production. The region which produces the largest proportion of the national production should be identified and all main productive regions of the country should be included.

The process must be based on a defined reference unit. A number of units, each characterised by peculiar advantages and disadvantages, could serve as indicators - for instance the beef cattle density per 100 ha of agricultural land, the share of dairy farms per km^2, or the amount of wheat/apple/wine in 1,000 tons per region. The rationale of the indicators is explained here for wheat:

- wheat production per region. This indicator can be misleading if the regions differ substantially in size, causing large regions to appear more relevant than small ones, regardless of wheat density (higher relative importance of wheat production). The same reasoning applies when the regional share of total wheat production is set as an indicator.
- wheat production per ha of arable land. This perspective is closer to agriculture, since the indicator excludes non-agricultural land and areas with other crops. However, a region with a very small share of agricultural land and only a few large, wheat-producing farms will be categorized as very important, whereas areas with extensive agricultural land and a higher diversity of products will appear less important.
- wheat production per km^2. This is a measure for absolute density that takes into account the different size of the regions, avoiding the disadvantages of the agricultural land perspective. However, it does not measure the relative importance of wheat production compared to other farming systems. This might be misleading when a region is relatively small and surrounded by non-wheat producing areas. Note that a substantial difference exists between productive regions and political regions: the former, in fact, are characterised by natural and bio-climatic conditions, rather than political boundaries.

3.1.3. Definition of the relevant farm population

Having identified the pertinent regions, it is necessary to establish whether the entire farm population is relevant to the analysis. *Agri-benchmark* and IFCN focus on those farms generating a high share of total income. The rationale to calculate the cost of compliance with environmental, animal welfare and food safety regulations is thus to select farms that are able to generate at least 50% of farmers' income (farms dependent on agricultural income) or to feed at least one person/family. The objective of the analysis must also be considered in the selection process. The selection criteria differ when concentrating on the economic situation of smallholder farms in wheat/beef/dairy production or when tackling international competitiveness.

The next stage concerns the selection of a limited number of farm(s), that differ in terms of production system(s). They should be drawn from the cluster previously selected. For the most important production systems for the typical farm network, it has to be checked if different systems cause differences in the database.

This step in the typical farm approach is best done by the country's experts, on the basis of the available literature and statistical analyses, and/or with the support of local advisors. A stepwise procedure is used, starting with a rather rough classification that will be gradually refined. This list of criteria is a proposal for a check-list and should be amended according to the regional conditions of the different networks. Some criteria listed might be less relevant for the selection procedure, so adaptation is required.

- Specialized arable, dairy, fruit, beef, sheep farms vs. mixed systems.
- Capital and labour-intensive vs. low capital/low labour input systems (e.g., no-till for arable farms; extensive grassland systems vs. confined systems in dairy, beef or sheep; quality wine production vs. "normal" wine production).
- Multi-product vs. one product farms.
- Storage of product on-farm vs. immediate sales of grain to the elevator after harvest.
- High yielding farms vs. low yielding farms, in terms of physical output.
- Marketing strategy (direct marketing of wine, dairy products).
- Family labour vs. hired labour farms.

3.1.4. Definition of the structure and size of the typical farm

After defining the relevant types of typical farms and their respective production systems, a decision is taken regarding the size of each typical farm. Their position within the total farm population should be well specified by detailing the number of farms in the population that are larger, smaller, or which fall in the same size category of each typical farm. This task can be accomplished by making use of data about the farm population (which will usually not be available at the level of detail required) or using representative random samples, which provide key indicators to measure the frequency of certain farm types and sizes (like the Farm Accountancy Data Network of the EU). A list of the issues that need to be addressed when defining the size of a typical farm and collecting data is provided below. As time and resources are usually limited, it is not always possible to reflect all farm sizes and production systems in a region. Based on the experience of *Agri-benchmark* and IFCN, the following recommendations are offered.

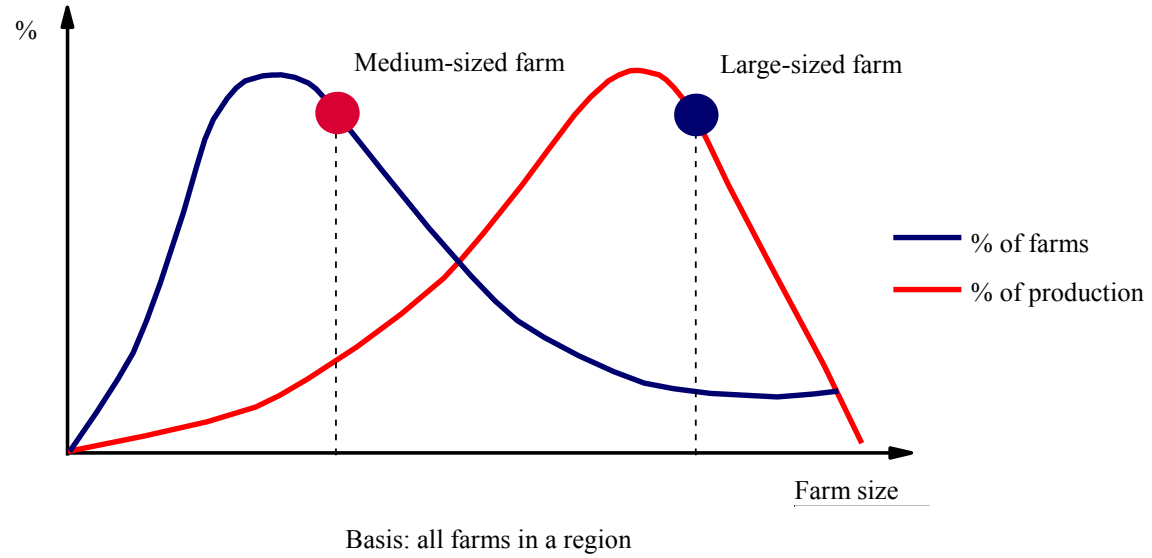
- In a region with minor differences in terms of production systems (for example in the Paris Basin region in France, or in Ireland, for dairy), two farms with the same production system but differing in size should be chosen. One farm should be of moderate size (usually slightly above average), the other farm should be large size and should belong to the approximately 20% of the largest farms of the whole population. Given the typical distribution of farm size classes (various small-sized enterprises with a relatively little share of production, and few large farms with a relatively high share of production, see figure 3.1) this enables the inclusion of a large number of farms and a major share of production in the analysis. Furthermore, it shows size effects: smaller farms could be affected more by specific regulations than large ones, or vice versa.
- Where possible, *Agri-benchmark* and IFCN use regional statistics about farm size distribution to ease the definition of appropriate farm sizes. Obviously, the availability of reliable statistical data is a precondition.
- In a region where (a) size differences are either not pronounced or appear irrelevant and (b) there are significant differences between production systems (e.g., intensive and low-input systems), two farms of about the same size should be chosen, reflecting the different systems.
- The typical farm should have an average management level. This allows conclusions regarding the impact of regulations on the production in a given region.

- In order to explore the potentials of a region/country, it is strongly recommended to add one large farm with top management to the set of farms. The technical standards of these top farms provide insight in which technical efficiency level can be reached when the limitations caused by average management are eliminated.

The quality of management is measured in terms of profitability. Farms with an average-level management should show an average level of profit, whereas top-management farms should rank in the upper 10% of large farms. When profit data are not available, gross margin or the physical productivity per unit of land are used as a proxy.

This project intends to reflect the latest data available, to yield the most recent picture of the economic situation and to reveal prevailing production systems of typical farms.

Figure 3.1 – Farm size distribution and selection of typical farm sizes



Basis: all farms in a region

Source: Deblitz and Zimmer, 2005

The question of how many typical farm models are required to represent the production of a specific product of a given country is frequently asked. In quantitative terms, there is no general answer to this question. Two farms are defined as the standard: one average farm and one large farm, both with average management, and eventually a third farm with top management. Beyond this general rule, the number of farms required per country mainly depends on:

- the diversity of production systems including natural conditions, economic conditions, and infrastructure conditions. If production systems are very diverse, an increase in the number of typical farms is required;
- the diversity of farm size structure and its increase usually requires an increase in the number of typical farms;
- the size of the country, since smaller countries usually require less farm types, while larger countries with a great variety of farming systems might be subdivided into different regions (as in the case of the U.S., Brazil and Australia);
- the spatial level of analysis, because fewer farms are required for international networks (usually 2 to 4 farms per country. For exceptions see previous point);
- the type of analysis performed. The number of required farms will increase when more adjustments have to be analysed;
- the financial feasibility, i.e. the resources needed to establish and maintain a network of typical farms in a country.

Experience so far has revealed that establishing a national network of typical farms in each country is the most effective method of generating information on a larger number of farms, and by doing so, to get a more detailed picture of both production systems and production costs.
It should however be underlined, that the limited number of typical farms per country does not allow to draw statistically significant conclusions. The results should therefore always be treated with care.

When statistics and resources to define typical farms are not available, a list of minimum criteria applicable to all products covered is made, to guide the first steps in determining a typical farm:

- select the region of the greatest importance for wheat, beef, sheep, dairy, pigs, broilers, apples, wine production in terms of tradable volume produced;
- within the region identified, select the production system with the highest share in regional production of the product to be analysed;
- select the farm size that produces the highest share of the product to be analysed within the production system identified;
- clarify as much as possible the location of the typical farm on the distribution function.

3.1.5. Data collection and assessment criteria

Data collection is done with the support of local advisors and farmers who know the region, the farms and the production systems. Both *Agri-benchmark* and IFCN use the so-called expert panels, consisting of the responsible scientist, an advisor and one to six farmers. The panel holds a round table meeting, where all required farm data are collected based on a standard questionnaire, available in several languages. The rationale of the method is a confrontation that creates a consensus on each figure, to properly describe how a typical farm looks like. The most frequent question raised during a panel discussion is: 'can this figure be considered typical for the type of farm we want to describe?'. The aim of the analysis distinguishes different intensity levels of farmers' participation, listed and described below.

- A "pre-panel" with only 1 or 2 farmers, appears to be sufficient for *status quo* analysis of economic performance and production costs. Often, it is also possible to base the typical farm data on individual farm data. However it is necessary (a) to identify and correct the particularities of individual farm data (to transform the latter into typical farm data), and (b) to perform farm visits to 2 to 3 farms with characteristics similar to the typical farm.
- A "full panel" with 4 to 6 farmers is required when farm adjustments to changes in the framework conditions or farm strategies are to be discussed and defined. The main reason is that more management options can be captured with a larger group. For this purpose, the data and the analysis derived from the pre-panel can be used as a basis for discussion.

An essential requirement for the farmers involved is that they must themselves run agricultural enterprises which are similar to the envisaged typical farm.

The collected data are computed by the analytical tools employed in *Agri-benchmark* and IFCN analyses, and results are returned to both the panel and the advisor. This process is repeated until the panel agrees on the results obtained, and a typical farm model is obtained.

In a final step, the results have to be compared with results from other economic analysis, i.e.by comparing the whole-farm profit of the typical farms with representative survey results. Such cross-checking assures that calculations and the typical farm selection procedures are aligned with other scientific results.

The *Agri-benchmark*, IFCN, Interpig and IPP networks selected for this study calculate the costs of production and express them in € per weight unit (kg, tons) of product. Therefore, this cost is the major criterion of judgement for all networks involved. The costs of production calculated for the reference year 2010 will be named hereafter **base scenario** (with legislation)**.** Compliance costs will

be: (a) subtracted from total production costs, when they are already included in the total costs because of their implementation in the past. In this case, the calculated production costs will be called without **scenario** (if the legislation was not in place); or (b) added to production costs of the base scenario, when the farmer will still have to comply with the legislation in the near future. In this case, calculated production costs will be called with **scenario**.

3.2. Assessing farmers' cost of compliance

The assessment procedure builds upon a focus group discussion with farmers and national experts. The boundaries to the analysis in terms of year and costs typology are clarified, and the methodology adopted to calculate the costs of compliance is presented.

3.2.1. General approach

The year 2010 is defined as a unique time reference for the costs calculations associated with the different products included in this study. The research assesses the costs of compliance with environmental, animal welfare, and food safety legislation in this time period, focusing on the costs that farmers sustain due to such legislation, both in EU and Third Countries.

To perform the calculations, a distinction between direct and indirect costs must first be made. Direct costs are borne by farmers as an effect of their compliance with public regulations and standards. Indirect costs, on the other hand, typically affect up- or down-stream supply chain actors, resulting both in higher input prices for farmers, as well as related indirect benefits for farmers. For example, high legislative standards for feed production, could potentially increase feed prices due to the compliance costs paid by feed mills. Such standards might also determine a concurrent improvement in animal health, causing a reduction in veterinarian costs, thereby increasing farm productivity. Other indirect costs are land prices and land rents, whose increase might follow from a higher demand for land caused by excess manure spreading.

A second important distinction to be made is between costs already incurred by farmers and associated with compliance to existing pieces of legislation, from costs that will arise due to regulations not yet enforced, but that already pose clear obligations. For the former, farmers and advisors must discover whether such costs would be avoided if the legislation were not implemented. Therefore, the calculation methodology requires subtracting the compliance costs from each single cost component. For the latter, the calculated compliance costs will be added to the single cost components of the total production costs in 2010.

Finally, direct benefits to farmers will also be accounted for- that is, those benefits that are generated when complying with the legislation. Higher yields due to the adoption of good agricultural and environmental practices constitute a clear example of such advantages. However, quantified benefits to society in terms of an improved environment or increased animal health will not be analysed, as they lay beyond the scope of this study.

3.2.2. Focus group discussion

Data concerning the countries targeted by the case studies are collected relying on the contribution of a selection of national experts, who in turn select and consult a panel of knowledgeable professionals. The panel is structured to ensure an adequate coverage of the disciplines required to achieve the objectives of the study. Specifically, the panels include experts in the fields of:

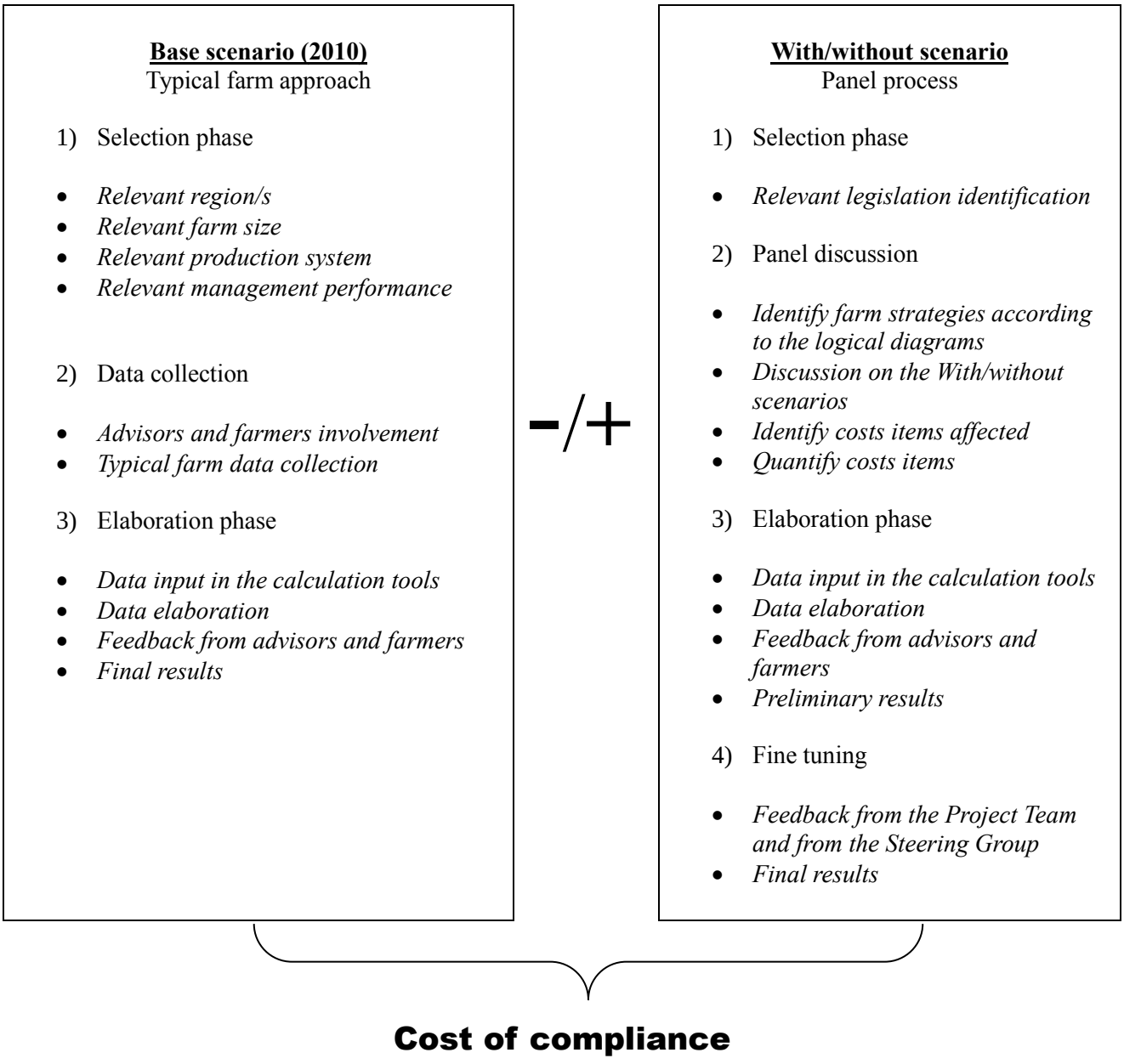
- agricultural engineering (livestock buildings and farm equipment);
- agronomy (cereals, fruits and vegetables and wine);
- animal production (dairy, beef, sheep, pork and broilers);
- veterinary science;
- plant protection technology;
- agricultural transportation;
- manure and slurry treatment;
- fertilization.

3.2.3. The calculation of compliance cost

Calculations follow an approach that considers each piece of legislation separately. The national experts adopt the methodological tools defined hereafter and consult the panel(s) for data collection. The data thus gathered is organized into an Excel© spreadsheet, and a cost calculation algorithm is defined which yields the compliance costs per single cost component as distinguished in the production cost methodology of the typical farm. According to the time-frame of the specific regulation, the calculated compliance costs are either subtracted from or added to the production costs for 2010 (Figure 3.2). Special attention is devoted to avoid double counting by addressing the issue of legislative overlaps. For instance, farmers may reduce the N-content of feed to comply with either the Nitrate Directive or the Integrated Pollution Prevention Control (IPPC). Suppose this

strategy is adopted in response to the Nitrate Directive: then the costs of compliance due the IPPC Directive are limited costs. Hence, the objective of these calculations is to highlight the combined effect of compliance costs, account for the synergies existing among the three normative areas, and the single pieces of legislation within a policy field. No distinction is made between EU Member States and Third Countries for the purposes of cost calculation. Farmers, as well as local advisors, are consulted by the national experts in order to identify the prevailing compliance strategies by means of questionnaires- and the typical farm approach serves the calculation of compliance costs here as well. Moreover, Third Countries farmers have to comply with EU legislations to be able to export their products to the European market. Therefore, in some cases, an extra typical farm will be set in Third Countries which represent the conditions of farmers who export to the EU.

Figure 3.2 – The methodological scheme



The methodological tool referred to in the figure above essentially consists of: (1) a questionnaire for data collection related specifically to the EU directives and regulations and their Third Countries equivalents; and (2) the calculation algorithm, which yields the cost of compliance with this legislation at the typical farm level. Both the questionnaires and the calculation algorithm strictly follow the path defined by the logical diagrams (for an example see Figure 2.3). A selection of the directives and regulations that are relevant to each case study is required since the set of standards might not always be entirely applicable or generate costs.

Note also that, for certain directives and regulations, the 2010 production costs of the typical farms already include the compliance costs. In these cases the estimated compliance costs are subtracted from production costs while for other directives and regulations, the compliance costs are added to production costs as their implementation is foreseen in the near future.

3.2.4. Definition of the cost items

The assessment of the cost of compliance with EU legislation targeting the environment, animal welfare and food safety was standardised in order to compare results. Such a standard applies to the tables illustrating said costs with respect to each of the legislative areas investigated, while the technical and economic changes implied by each piece of legislation are quantified according to their specific characteristics. The standard adopted relies on a number of items describing expenditures for the categories of land, labour, capital and non-factor costs, as well as total revenues and specific product revenues. Note that decoupled payments are excluded from the calculations. The definition of each cost and revenue item follows below:

Cost items

- Land costs: includes the cost for rented land and the cost of own land (based on land rent).
- Labour costs: includes the cost for contract labour and the cost of family labour.
- Capital costs: includes the interest paid on liabilities and the interest on own capital
- Non-factor costs: result from subtracting the costs for land, labour and capital from total cost; the item includes the figures related to feed, contractors, maintenance and depreciation of machinery and buildings, and others.

Revenue items

- Product revenues: quantifies the income derived from sales of the main product, depending on the case study: milk, beef meat, sheep meat, pork meat, broilers, wheat, apples, or wine grapes.

4. Results

This chapter presents the outcomes of the eight case studies performed on the selected agricultural productions: milk, beef meat, sheep meat, pork meat, broiler meat, wheat, apples, and wine grapes. For each product information is provided about the rationale that guided the selection of the countries studied, the national structure of the sector, and the characteristics of the typical farm(s) set in the country. Thereafter, results are discussed in a comparative analysis that distinguishes among production costs, selected legislation, and compliance costs with said legislation.

4.1. Case study: Dairy

4.1.1. Choice of countries

In order to represent all the different aspects of the European Union's dairy sector, five EU Member States and two Third Countries with peculiar characteristics were chosen. The countries investigated in the dairy sector are: Germany, the Netherlands, Ireland, Poland, Finland, Argentina and New Zealand. These countries were among the top-45 dairy producing countries in the world in terms of tonnes of milk produced in 2010 (FAOSTAT 2012).

The Netherlands represent an intensive farming system in a temperate climate. In Ireland, the climate is mild, and grazing is possible for most of the year. Finland, at the northern edge of the continent, faces short summers and harsh winters which makes farming and fodder production more difficult. In Germany, in the midst of Europe, all three different systems are present. The large family farms in the north are akin to the one in The Netherlands, while in the south, there are smaller family farms, which face harsher winters and less favourable climatic conditions. The climate in the South is determined by the proximity to the mountains. The eastern regions of the country have a history of huge corporate farms, a legacy from communist times. Poland represents the eastern part of Europe, where it is possible to find both small family (household) farms and larger family farms which evolved during the last two decades.

One of the Third Countries with the most intensive dairy production in terms of animals per ha of land is New Zealand. This is the reason why this country was chosen as the first Third Country representative. In New Zealand, farms are based on year round grazing and low input. Production costs are low and aligned to global milk prices as the country exports 95% of its production. The

second Third Country selected is Argentina, which also predominantly applies a grazing system, but with a higher input of concentrate feed and thus a higher milk yield than in New Zealand.

4.1.2. National farm structure

Table 4.1 presents selected key variables of milk production in the countries which were chosen for the case studies. Germany (ranking 6th in the world) produced over 30 million tons, while Finland produced only 2.4 million tons of milk in 2010. The number of dairy cows and the milk yield per cow varied accordingly. While the Netherlands, Finland, and Germany had high yielding cows, producing more than 7 tons per cow per year, Ireland, Poland, and New Zealand dairy cows produced around or less than 5 tons of milk. The total number of dairy farms per country varied significantly, ranging from 11.000 in Finland to 465.000 in Poland. The number of farms is mainly dependent on average farm size. In Poland, an average dairy farmer owned 5 cows, whereas in New Zealand, average farms could own up to 376 cows. Within the EU, average herd size varied between 5 in Poland and 75 in the Netherlands. The Third Countries, New Zealand and Argentina have pasture-based dairy systems. It follows that in Argentina as in New Zealand, the average herd counted more than 150 heads.

Table 4.1 – General information on milk producing countries, 2010

	unit	FI	DE	IE	NL	PL	EU-27	AR	NZ	World
Production	million tons	2.45	30.47	5.31	12.77	11.93	157.2	10.07	19.16	739.4
Cows	1,000 heads	289	4,182	1,122	1,477	2,529	23,216	1,749	4,397	348,908
Milk yield	t/cow/year	8.5	7.3	5.1	8.6	4.7	6.5	5.8	4.4	2.1
Total farms	1,000 units	11	91.6	18	20	465	1,876	11.2	12	348,908
Average farm size	heads	26	46	61	75	5	12	157	376	3
Currency		EUR	EUR	EUR	EUR	Zloty	EUR	Peso	NZD	-
GNI per capita[13]	$	36,570	38,410	34,410	41,010	19,220	-	n/a	28,310	-

Source: IFCN Dairy Report, FAOSTAT, World Bank

[13] Gross National Income (GNI) per capita is based on purchasing power parity (PPP). The indicator is calculated converting gross national income to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.

4.1.3. Typical farm structure

For most countries involved in this study, two dairy farms are described, one average farm and one larger farm. For the Netherlands and New Zealand, only one farm was included, as the production system was very similar throughout the country independent of the size of the farm. For Germany, three farms are part of the study, as the systems and farm sizes vary substantially in the north, south, and east of the country. Farm names consist of an abbreviation for the country plus a number indicating the number of dairy cows on that respective farm.

The most important variables used to describe a dairy farm are listed in Table 4.2. In Europe, herds with less than 100 dairy cows appear to be common, and only the East German farms, due to their strong communist background, are substantially larger. In the Third Countries chosen for this study, both based on grazing, large herd sizes with up to 1,000 cows are common. The total amount of land on the farm is listed. For some countries, only a few hectares are used for marketable crops and dairy still constitutes the farm's major income. The East German farm is a large crop enterprise of more than 1,000 ha alongside the dairy enterprise. In this example, both parts are of equal importance economically.

The predominant breed worldwide is Holstein Friesian, due to its high yield potential. In regions with more difficult breeding conditions due to the climate or, in the case of Poland, in light of local traditions, other breeds prevail which are more suitable to specific conditions. For example, in Bavaria (southern Germany), Simmental (locally known as Fleckvieh) is commonly present; in Finland, a red breed, the Finnish Ayrshire, is the predominant breed, while Polish farmers still raise a local breed. Cows in New Zealand have traditionally a certain proportion of Jersey blood, as these animals are better adapted to the low input farming system due to their small size and high milk yield potential.

Milk yields range between 4,000 and 9,000 kg of milk per year. Due to the widely varying milk solids, the milk is energy corrected to the same content of 4% fat and 3.3% protein. This means that the amount of milk with high milk solids increases, especially in New Zealand, while the amount of milk with milk solids below the threshold decrease, especially in Argentina. The farms in Finland and Northern Germany lie within less favoured areas.

Dairy farming is still mainly a family-run system. In some of the farms outside the EU, several families own and run a farm together. Business farms which are not owned by individual persons, but by a legal entity, are common in East Germany, A similar structure is found in the large Argentinean farm's operation. As the name suggests, family farms are owned by a family and the family also provides the biggest share of the labour force. Only a minor part of the work is done by employees. On business farms, but also on farms owned by a family partnership, most or even all of

the work is carried out by employees. Labour requirement per cow change according to the farming system. The most labour intensive farm is the small Finnish farm with its stanchion barn and a pipeline milking system. This type of farm requires one labour unit to manage ten cows. In contrast, on larger farms in New Zealand (characterized by a grazing system and no additional feeding), one labour unit is assigned to 190 cows.

If the climatic conditions allow for the cows to stay outside all year round, the pasture system predominates. In the cases where this system is not applicable, two different types of housing are identified: small herds with not more than approximately 30 to 40 cows housed in stanchion barn and large herds kept in free stall barns where animals can move around freely. The milking system depends on the housing system: pipeline milking appeared to be typical of stanchion barns (i.e. the milking person goes to the cows), whereas the milking parlour is typical for the larger herds (i.e. the cows go to the milking person). In the case of the extensive 1,000 cow herd in New Zealand, a rotating platform is used. This technique allows for a high number of cows milked per hour. In Europe, part of the housed cows also have access to grazing for several months in summer. This is highly dependent on herd size, as it is more difficult to send several hundred cows out to pasture. The characteristics of the farm, i.e. availability of pasture and location of land in relation to farm buildings is also an important factor. The farm in Northern Germany, the very large farm in East Germany, and the large Finnish farm house their cows all year round.

The last rows of the table provide information about fertility and replacement rates. The replacement rate fluctuates between 20% in Ireland and more than 40% in Germany, i.e. in Ireland a cow is part of the herd for 5 years, while in Germany the cow will be replaced after 2.5 years. In general, the replacement rate is lower in grazing systems, i.e. cows have a longer life expectancy in these herds. Calf mortality until weaning varies between 5 and 15% across the countries. Most farms show a calf mortality of 10% and higher. At least every 10^{th} calf did not survive the first 2 months of life.

In the following is a short description is given of the dairy farms with their most important characteristics.

FI25: represents an average sized farm with 25 cows in a stanchion barn with a pipeline milking system. The dominant breed is a cross between the Finnish Ayrshire and the Holstein, with an average milk yield of 8350 kg per cow per year. The farm relies strongly on direct payments and also has cash crop and forest land on their 52.8 ha.

FI69: represents a larger farm in Finland with 69 cows which are a Finnish Ayrshire*Holstein cross. Cows are kept indoors all year round in a loose housing system with a milking parlour. The milk yield is 8320 kg milk/cow and year. On 105 ha, the farm also has a cash crop enterprise.

DE31S: represents an average sized farm for southern Germany, having dual purpose cows (Simmental) with a milk yield of 6600 kg milk/cow per year. The cows are kept in a stanchion barn where milking is done via a pipeline system. The farm operates on 39 ha of land (58 % grassland) and has cash crop income besides dairy. The farmer does contractor work for other farmers as well. About 96% of the work on the farm is done by family members.

DE95N: represents an average sized farm for northern Germany. It has Holstein Friesian cows with an average milk yield of 8,900 kg milk/cow per year. The cows are kept in a free stall barn where milking is done via a 2*6 herringbone parlour. The farm operates on 97 ha land (46 % grassland) and has some cash crop returns. It fattens its male calves. Besides the family members, a share of the work is done by young people being trained as farmers on the farm.

DE650: represents a farm in East Germany which emerged from the former communist system. It is a business farm where the work is exclusively done by employees. The HF cows have an annual milk yield of 8,700 kg/cow. More than 60% of the 1,700 ha are used for a crop enterprise.

IE48: represents an average sized farm in Ireland with a free stall barn for the winter months and a milking parlour. The farm operates on 41 ha of grassland. With its Holstein cows and the seasonal grazing system (supplemented with compound feed), it has a milk yield of 7130 kg/cow per year. About 90% of the work is done by family members.

IE115: represents a larger farm operating on 83 ha of land of which more than 90% are used for the dairy enterprise. The HF cows are mainly grazing and reach a milk yield of 6,650 kg/cow per year. The work is done exclusively by family members.

NL76: represents an average sized farm operating on 44 ha land (90 % grassland) with a free stall barn and a milking parlour. The average milk yield is 7,930 kg. About 90% of the work on the farm is done by family members and the majority of forage production work is done by contractors.

PL15: represents an average sized family farm with a stanchion barn and a pipeline milking system. The cows are a cross of a local breed and HF, reaching a milk yield of 6,680 kg/cow per year. The farm operates on 32 ha which are mainly used to produce forage and grain for the dairy cows. All the farm work is done by family members.

PL65: represents a larger farm, having HF cows with an annual milk yield of 8,530 kg milk/cow. The cows are kept in a free stall barn with a parlour milking system. The farm operates on 100 ha of land (75% pasture land) which is mainly used for the dairy enterprise. This family farm also employs two farm workers.

AR170: represents an average sized farm with 227 ha of land located in the Santa Fe province. The milk yield is 5,460 kg/cow per year. Besides grazing, compound feed is provided. Milking is done in a parlour. About 20% of the work is done by family members.

AR400: represents a larger farm on 485 ha of land (55% pasture land). The HF cows are grazed throughout the year and reach an annual milk yield of 6,040 kg/cow. 30% of the land is used for a crop enterprise. It is a corporate farm where nearly all of the work is done by employees.

NZ974: represents a larger farm on South Island in New Zealand. The farm owns 374 ha which are only used for grazing. The milk yield of the Holstein Jersey cross cows is 5,230 kg milk. Cows are milked on a rotary platform. The farm is owned by a family partnership and more than 80% of the work is done by employees.

Table 4.2 – Typical farms: key variables of the dairy herd (EU)

	unit	FI25	FI69	DE31	DE95	DE650	IE48	IE115	NL76	PL15	PL65
Dairy cows	heads	25	69	31	95	650	48	115	76	15	65
Land	ha	53	105	39	97	1700	44	83	44	32	100
Breed		Ayr/HF	Ayr/HF	SI	HF	HF	HF	HF	HF	HF+local	HF
Milk yield ECM	kg/cow/year	8.734	8.698	6.851	9.228	7.881	7.135	6.917	8.435	6.681	8.569
LFA[1]		yes	yes	no	Yes	no	no	no	no	no	no
Legal form[2]		FFB	FFB	FFB	FFB	BF	FFB	FFB	FFB	FFB	FFB
Employees[3]	units	0	0.4	0	0.7	23.1	0	0	0.1	0	2.0
Family[3]	units	2.5	2.4	1.5	1.5	0	1.9	3.0	1.2	2.5	2.5
Production system		stanchion barn	free stall	stanchion barn	free stall	free stall	grazing	grazing	free stall	stanchion barn	free stall
Housing system		indoor + 5 months grazing	indoor	indoor + 6 months grazing	indoor	indoor	grazing	grazing	indoor + 6 months grazing	indoor + 5 months grazing	indoor + 5 months grazing
Milking system		pipeline milking	parlour milking	pipeline milking	parlour milking	parlour milking	parlour milking	parlour milking	parlour milking	pipeline milking	parlour milking
Replacement rate	%	29.8	29.2	34.7	42.1	40.7	20.0	21.4	34.0	33.5	34.1
Stillbirth and calf deaths until weaning	%	7.0	10.0	8.0	12.0	14.0	5.0	10.0	14.0	10.0	9.0

[1] LFA = less favoured area, applicable only to EU member States

[2] Legal form: FFB = family farm business; BF = agribusiness farm; CF = cooperative farm

[3] it is assumed that each family or employed worker is full-time employed on farm and works for 2,100 hours/year

Source: IFCN Dairy Report

Table 4.3 – Typical farms: key variables of the dairy herd (Third Countries)

	unit	AR170	AR400	NZ974
Dairy cows	heads	170	400	974
Land	ha	227	485	374
Breed		HF	HF	Jersey *HF
Milk yield ECM	kg/cow/year	5.226	5.802	5.855
LFA[1]		-	-	-
Legal form[2]		FFB	BF	FFB
Employees[3]	units	3.3	6.2	4.5
Family[3]	units	1.0	0.7	0.7
Production system		grazing	grazing	grazing
Housing system		grazing	grazing	grazing
Milking system		parlour milking	parlour milking	rotary platform
Replacement rate	%	23.5	25.0	27.0
Stillbirth and calf deaths until weaning	%	15.0	14.0	10.0

[1] *LFA = less favoured area, applicable only to EU member States*

[2] *Legal form: FFB = family farm business; BF = agribusiness farm; CF = cooperative farm*

[3] *It is assumed that each family or employed worker is full-time employed on the farm, and works for 2,100 hours/year*

Source: IFCN Dairy Report

4.1.4. Production costs by typical farm

This section offers an overview of the total cost of production in the typical dairy farms. It deals with their cost structure, as reported according to the major cost areas analysed. The latter include land cost, labour cost, capital cost, and non-factor costs. Note that the goal of this section is to compare the typical farms as portrayed in the *base scenario*. Therefore the figures refer to the situation where legislation is enforced and the year 2010 is the reference year for the cost calculation.

Results are presented in Table 4.4 and Figure 4.1. This figure offers a clear illustration of the characteristics of each typical farm. Costs are shown as stacked bars, where the sum represents the total cost level. Revenues from milk are represented as a line. The table provides the absolute cost values and revealing the specific differences for each factor across the countries involved. This makes it easier to focus on the differences that characterise typical farms in the EU and Third Countries.

The share of land and capital costs in the total production costs is generally low for both the typical EU and Third Country farms studied. Labour costs show a higher variability. Labour costs represent the major portion of the total production costs for Finland and the South of Germany but are negligible for the large grazing farms in Argentina and New Zealand. Generally, non-factor costs turn out to be the leading cost factor. The milk revenues cover the non-factor costs in most countries with the exception of the larger farm in Finland (FI-69) and smaller farm in Germany (DE-31). They only cover the total costs on the large farm in Germany and on the farms in Ireland, Argentina and New Zealand. Land, labour, and capital costs are not fully covered in Finland, on the two smaller farms in Germany, in the Netherlands, and in Poland. On all farms, these costs are partly cash costs, i.e. the land is rented and labour is done by employees, and partly opportunity costs, i.e. land is owned and the work is done by the farmer. On these farms, opportunity costs are not fully covered, i.e. land and labour of the farmer are not remunerated at market prices.

Table 4.4 – Milk production costs in selected countries, 2010

cost items	unit	FI25	FI69	DE31	DE95	DE650	IE48	IE115	NL76	PL15	PL65	AR170	AR400	NZ974
land costs	€/100 kg	4.04	2.2	5.23	3.92	2.03	2.26	3.13	4.15	2.91	3.27	2.32	2.66	3.49
labour costs	€/100 kg	31.31	13.25	22.77	6.59	7.08	11.33	8.03	9.41	12.96	7.54	4.22	3.92	2.76
capital costs	€/100 kg	2.61	5.83	2.65	1.90	1.54	0.49	1.07	4.93	0.75	2.45	0.75	0.73	2.21
non-factor costs	€/100 kg	37.09	48.87	34.7	22.58	24.07	16.96	14.48	23.48	24.04	24.41	12.67	14.85	14.73
total costs	€/100 kg	75.05	70.15	65.35	35.00	34.72	31.04	26.71	41.96	40.66	37.68	19.95	22.16	23.18
milk price	€/100 kg	36.7	37.3	30.9	29.4	34.3	29.2	28.9	30.40	25.2	27.1	25.8	26.3	25.1

Own calculation

Table 4.5 – Production costs drivers: dairy

cost items	unit	FI25	FI69	DE31	DE95	DE650	IE48	IE115	NL76	PL15	PL65	AR170	AR400	NZ974
Rent arable land	€/ha	178	129	341	400	210	300	300	600	175	175	297	198	-
Rent pasture land	€/ha	50	50	231	350	190	300	300	600	175	175	76	72	532
Labour (for family)[1]	€/h	14	14	15	15	15	10	10	23	3	3	7	12	25
Concentrate[2]	€/t	200	200	198	210	235	236	236	204	225	237	108	115	-
Diesel[3]	€/l	0.61	0.61	1.15	1.00	1.12	0.73	0.73	0.88	1.14	1.14	0.71	0.71	0.68
Electricity	€/kWh	0.09	0.09	0.19	0.16	0.18	0.16	0.16	0.20	0.14	0.14	0.07	0.07	0.06

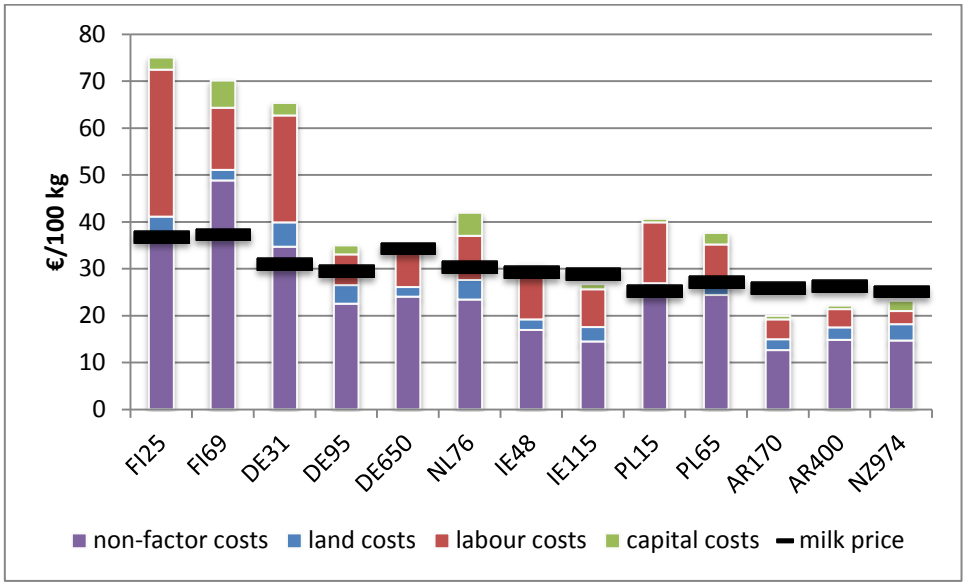
[1] *Labour cost: the opportunity cost for family labour, calculated as the amount of money a person with similar skills would earn when replacing the farmer*

[2] *Concentrate: the purchasing price that farmers pay when buying concentrate from the feed mill*

[3] *Diesel: the purchasing price*

Source: IFCN Dairy report

Figure 4.1 – Milk production costs in selected countries, 2010



Own calculation

The different level of production costs noticed in the previous figure can be ascribed to a number of parameters (quantified in the table below) which, together with those listed in section 1.3 "typical farm structure", constitute the major drivers for the cost differences.

Table 4.5 presents a comparison of the prices for the most common input and output factors. This is to demonstrate the different cost levels under which the farms have to operate. Milk and beef prices are high in Finland, Germany, and the Netherlands and low in Argentina and New Zealand. Land prices vary considerably. Farmers in countries with the highest intensity in terms of fodder production per hectare/ land (In the Netherlands where housing is practiced, a hectare of dairy land produces feed for roughly 8,500 kg milk, and in New Zealand with a grazing system, a hectare of dairy land produces grass for approximately 15,000 kg milk) have the highest land prices. The labour costs for the farmer are also high in these countries while they are very low in Poland. Concentrate prices are relatively stable in the EU. They vary between 200 € and 240 €. In the Third Country Argentina, prices are about half that. In New Zealand, cows are not fed with concentrates, therefore no price for concentrates is given for this country. Both diesel and electricity prices fluctuate by a hundred per cent within the EU. The lowest prices are found in Finland and these are at same level as in Argentina and New Zealand.

4.1.5. Selected legislation

The influence of the specific set of legislations selected for the dairy case study on the economics of milk production was assessed for the selected countries. For the dairy sector, 16 directives and

regulations were considered altogether. These were the directives which affected dairy husbandry and milk production the most. The directives were clustered into the groups "environment" (ENV), "animal welfare" (AW), and six different groups of "food safety" and animal health (FS). ENV contains the nitrate directive which deals with slurry management in a broader sense. AW interests the welfare of calves. FS 1 concerns regulations for feed mills. FS 2 includes disease prevention, i.e. foot and mouth disease, bluetongue and zoonotic diseases. FS 3 regards the use of hormonal substances. FS 4 covers the identification and registration of animals. FS 5 is concerned with the prevention of BSE, while FS 6 group regulations regarding the hygiene and traceability of food of animal origin.

4.1.5.1. Legislation requirements

An initial comparison was made of the directives selected for each of the areas investigated (environment, animal welfare, and food safety) with their specific requirements. The study tried to determine whether the requirements were applicable to each of the countries chosen. It also deals with how they had been transposed into the national set of norms. The aim of the table is to offer an immediate insight in the binding legislative conditions affecting milk production. The two Third Countries were added to the comparison together with the EU Member States in order to cover equivalent legislation. No explicit reference to their particular body of laws is made. This comparison of the legislative requirements lays an interesting foundation for the subsequent analysis of the costs of compliance.

Table 4.6 – Specific normative requirements of selected legislation for milk production

code	legislation	FI	DE	IE	NL	PL	AR	NZ
ENV	**Nitrate Directive (91/676/EEC)**							
	o Max level of N from animal manure (kg N/ha)	170	170	170	250	170	o	o
	o No nitrogen on water logged or frozen land	x	x	x	x	x	o	o
	o Obligatory fertiliser planning + soil samples	x	x	o	x	x	o	x
	o Annually farm based nutrient balance	x	x	o	x	x	o	x
	o Application of fertilisers has to be recorded	x	x	x	x	x	o	o
	o Buffer strips to water courses inside NVZ	x	x	x	x	x	o	x
	o Minimum storage capacity required	x	x	x	x	x	o	o
	o Special equipment to avoid leakage/no structural defects	x	x	x	x	o	o	o
	o Catch crops on maize land	o	o	o	x	o	o	o
	o Correct transport of excess manure	o	o	o	x	o	o	o
AW	**Protection of calves Directive (2008/119/EC)**							
	o Minimum box sizes and appropriate flooring	x	x	x	x	o	o	o
	o Requirements on light, air, ventilation	x	x	x	x	o	o	o

code	legislation	FI	DE	IE	NL	PL	AR	NZ
	○ Regular feeding and availability of water	x	x	x	x	o	o	o
	○ Feed ingredients (fibre, iron)	x	x	x	x	o	o	o
	○ Regular checking and surveillance of animals	x	x	x	x	o	o	o
	○ Group housing and skin contact with other calves	x	x	x	x	o	o	o
FS1	**Directive on Undesirable substances in animal feed (2002/32/EC)**							
	○ Feed should not be contaminated with undesirable substances	x	x	x	x	o	o	x
	Directive on Medicated feedstuff (90/167/EEC)							
	○ Substances have to be approved	x	x	x	x	o	o	x
	○ Medication has to be authorised	x	x	x	x	o	o	x
	Regulation on Feed hygiene (183/2005)							
	○ Feed should not be contaminated	x	x	x	x	o	o	x
	Regulation on Additives for use in animal nutrition (1831/2003)							
	○ Additives have to be approved and labelled	x	x	x	x	o	o	x
	Regulation on Marketing and use of feed (767/2009)	x	x	x	x	o	o	x
FS2	**Directive on Prevention of foot-and-mouth disease (2003/85/EC)**							
	○ Vaccination	o	o	o	o	o	x	o
	Directive on Prevention of bluetongue (2000/75/EC)							
	○ Vaccination of animals	o	x	o	o	o	o	o
	Directive on Prevention of zoonoses and zoonotic agents (2003/99/EC)							
	○ Regular tests	x	x	o	o	o	o	x
	○ Quarantine facilities	o	o	x	o	o	o	o
	○ Protective clothes and shoes for visitors	x	o	o	o	o	o	o
	○ Shower facilities for staff	x	o	o	o	o	o	o
	○ Disposal of dead animals at a knackery	x	x	x	x	o	o	o
	○ Vaccination (leptospirosis, brucellosis, tuberculosis)	o	o	o	o	o	x	x
FS3	**Directive on prohibition of hormonal substances (96/22/EC)**							
	○ No use of BST in cattle feed	x	x	x	x	x	x	x
FS4	**Regulation on Identification and registration of bovine animals (1760/2000)**							
	○ Marking each animal after birth or arrival on farm with 2 ear tags	x	x	x	x	x	x	x
	○ Replacement of lost ear tags	x	x	x	x	x	x	x
	○ Registration of all births, deaths, animal movements	x	x	x	x	x	x	x
FS5	**Regulation on Prevention of TSE (999/2001)**							
	○ No animal protein in cattle feed	x	x	x	x	o	x	x

code	legislation	FI	DE	IE	NL	PL	AR	NZ
FS6	**General principles (Regulation 178/2002)**	x	x	x	x	o	o	o
	o Recording sale and purchase of feed stuffs	o	x	o	o	o	o	o
	o Milking under hygienic conditions	x	x	x	x	o	x	x
	o Cooling of milk	x	x	x	x	o	x	x
	o Adequate storage of milk	x	x	x	x	x	x	x
	o Recording of medical treatment of animals	x	x	x	x	o	o	x
	o Water analysis	x	o	o	o	o	o	o

Symbols: x = enforced in the country; o = no specific legislation

A. ENVIRONMENT

The **Nitrate Directive (91/676/EEC)** applies to all EU Member States, and acts to defend the environment. Comparable national legislations exist in New Zealand, while Argentina provides only minimal recommendations for water protection. The Directive aims at protecting ground- and surface water from the pollution caused by nitrates deriving from agricultural sources. It also encourages the adoption of good farming practices. Its implementation takes place through the establishment of Nitrate Vulnerable Zones (NVZs). If a territory is classified as a NVZ, the producer must comply with a NVZ Action Programme, which includes a number of measures.

- There is a general ban on the application of chemical fertilisers or manure during autumn and winter. Organic manure or N fertilisers cannot be applied where the ground is waterlogged, flooded, frozen hard or covered with snow.
- Slurry storage facilities with sufficient capacity must be available to cater for the closed period, or alternative arrangements should be made.
- Crop requirement limits must be respected by not applying more N than a crop requires, taking into account elements like crop uptake, soil N supply, excess winter rainfall, and plant or crop available N from organic manures.
- N fertilisers and organic manure should be spread as evenly and accurately as possible. Furthermore, they cannot be applied to steeply sloping fields and in a way that contaminates watercourses. Organic manures cannot be applied within 10 m of watercourses.
- Any material or fertiliser that contains N and is applied to the land must be considered in the N fertiliser calculations. Producers must keep farm and field records on cropping, livestock numbers, N fertiliser usage and manure usage for a minimum of five years after the relevant activity takes place.
- The Nitrate Directive, finally, limits the stocking rate to 170 kg N/ha per year.

The directive has been implemented differently across the Member States, due to adjustment to national conditions and requirements, e.g. storage capacities for slurry were adjusted to geographical conditions and housing systems. In the Netherlands a derogation was granted, allowing for the application of up to 250 kg organic N/ha under specified conditions.

B. ANIMAL WELFARE

The Directive on the **Protection of Calves** (**2008/119/EC)** is implemented in four of the five EU-countries considered, whereas in Poland enforcement began in January 2013 therefore lying beyond the scope of this research. Similar regulations do not exist in New Zealand and Argentina, where grazing is usually practiced throughout the year.

C. FOOD SAFETY AND ANIMAL HEALTH

The five directives and regulations listed in the group **FS1** (**Directive 2002/32/EC, Directive 90/167/EEC, Regulation 183/2005, Regulation 1831/2003, Regulation 767/2009**) deal with the conditions of feed production at feed mills. The hygienic conditions and the supplementation of ingredients in feed, be they undesirable substances, medication or additives, are closely regulated. In New Zealand, a similar food hygiene regulation exists.

The three directives summarised in **FS2** (**Directive 2003/85/EC, Directive 2000/75/EC, Directive 2003/99/EC**) deal with the prevention of foot-and-mouth disease, bluetongue, and zoonotic diseases. They were implemented with different measures in Germany, Finland, and Ireland as directives allow Member States to achieve a common goal in their own individual way. The focus is mostly on the prevention of zoonotic diseases, as a general prevention, and all countries have to dispose of their dead animals at a knackery, even in remote areas. The selected Third Countries require tests and vaccinations as well, to prevent the spread of diseases.

In all seven EU Member States and Third Countries, the use of hormonal substances, specifically BST, is forbidden. Therefore the **Directive 96/22/EC (FS3)** does not have an impact on production systems.

The identification and registration of animals **(Regulation 1760/2000, FS4)** is enforced in all EU and Third Countries. All animals have to be tagged shortly after arrival on the farm, whether at birth on the farm or their arrival after being purchased. Lost tags have to be replaced, and all changes in the herd, i.e. births, deaths, sale, and animal movements, have to be meticulously recorded.

The **Regulation 9999/2001 (FS5)** forbids the use of animal protein in cattle feed, in order to prevent an outbreak of BSE. This regulation is not yet in force in Poland. Similar regulations also exist in Argentina and New Zealand.

The three regulations in **FS6 (Regulation 178/2002, Regulation 931/2011, Regulation 853/2004)** concern, on the one hand, the traceability of feedstuff and animal products, and on the other hand hygienic rules for the production of food of animal origin. This regulation affects mainly the production, cooling, and storage of milk. As dairy processors in all the countries investigated impose very high standards on milk producers, these regulations would be complied with anyway, without any additional impact on the production system. Also in Poland, dairy processors demand high quality milk so milk is produced under hygienic conditions, even though this regulation is officially not yet in force. The traceability of animal products also requires a detailed recording of the administration of drugs and medication to the animals which entails additional office work for EU farmers. This is also required in New Zealand, but not in Argentina.

D. NEW MEMBER STATE: POLAND

Let us examine the case of Poland, where the cross-compliance requirements, or Statutory Management Requirements (SMR), are being implemented gradually according to a number of stages.

Table 4.7 – Timetable of the implementation of selected EU directives in Poland

Stage	Area	Legislation	Requirement
from January 2004	Environment	Directive 91/676/EEC on the protection of water against pollution caused by nitrates from agricultural sources. By 2010, 2% of the agricultural land was declared NVZ.	SMR 4
from January 2009	Environment	Directive 91/676/EEC on the protection of water against pollution caused by nitrates from agricultural sources	SMR 4
	Animal identification and registration	Regulation (EC) 1760/2000 establishing a system for the identification and registration of bovine animals (labelling of beef and beef products), amending Regulation (EC) 820/97	SMR 6-8
from January 2011	Public health Animal health Reporting of diseases Plant health	Council Directive 96/22/ECC of 29 April 1996 concerning the prohibition on the use in stock farming of certain substances having a hormonal or thyrostatic action and of beta-agonists, and repealing Directives 81/602/EEC, 88/146/EEC and 88/299/EEC	SMR 10
	Public health	Regulation (EC) 178/2002 laying down the general	SMR 11

Stage	Area	Legislation	Requirement
	Animal health Reporting of diseases Plant health	principles and requirements of food law, establishing the European Food Safety Authority, and laying down procedures in matter of food safety	
	Public health Animal health Reporting of diseases Plant health	Regulation (EC) No 999/2001 of the European Parliament and of the Council of 22 May 2001 laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies	SMR 12
	Public health Animal health Reporting of diseases Plant health	Council Directive 85/511/EEC of 18 November 1985 introducing Community measures for the control of foot- and-mouth disease	SMR 13-15
	Public health Animal health Reporting of diseases Plant health	Council Directive 2000/75/EC of 20 November 2000 laying down specific provisions for the control and eradication of bluetongue	SMR 13-15
from January 2013	Animal Welfare	Council Directive 91/629/EEC of 19 November 1991 laying down minimum standards for the protection of calves	SMR 16-18

4.1.5.2. Cost items and potential impact at farm level by country

In the following table, the cost items generated by the implementation of the legislation at the farm level are listed. The detailed list is based on information collected via experts and panel discussions, carried out in each country to identify real additional costs faced by the farmers due to the legislation. The cross indicates in which countries the cost item is identified as a cost of compliance.

Table 4.8 – Comparison of legislative areas impacting cost of compliance in milk production

	legislation	obligation	FI	DE	IE	NL	PL	AR	NZ
ENV	Nitrate Directive	storage capacity for slurry (and silage liquid)	x	x	x	x	x		
		manure handling equipment				x			
		transport and removal costs	x			x			
		sampling (slurry, soil, roughage)	x			x			
		fertiliser plans, consultant fee			x	x			X
		administration	x		x	x			X
		fencing and protection of riparian strips							X
AW	Protection of calves	calf housing		x					
FS 1	Feed mills	standards at feed mill	x	x	x	x			X

	legislation	obligation	FI	DE	IE	NL	PL	AR	NZ
FS 2	Prevention of zoonoses	disposal of animals at the knackery	x		x				
		animal checks by farmer or veterinary	x						
		quarantine facilities			x				
		shower rooms for employees	x						
	Diseases prevention	treatment against foot-and-mouth disease, Bluetongue, zoonotic diseases (leptospirosis)		x		x		x	X
FS 4	Identification and registration of animals	registration and identification	x	x	x	x	x	x	X
FS 5	Prevention of TSE	concentrate without animal protein			x				
FS 6	Traceability and hygiene requirements	water analysis	x						
		recording medical treatments		x	x	x			X
		recording sale of feed		x					
		administration	x						X

Symbols: x = identified as compliance cost

4.1.6. Cost of compliance with selected legislation

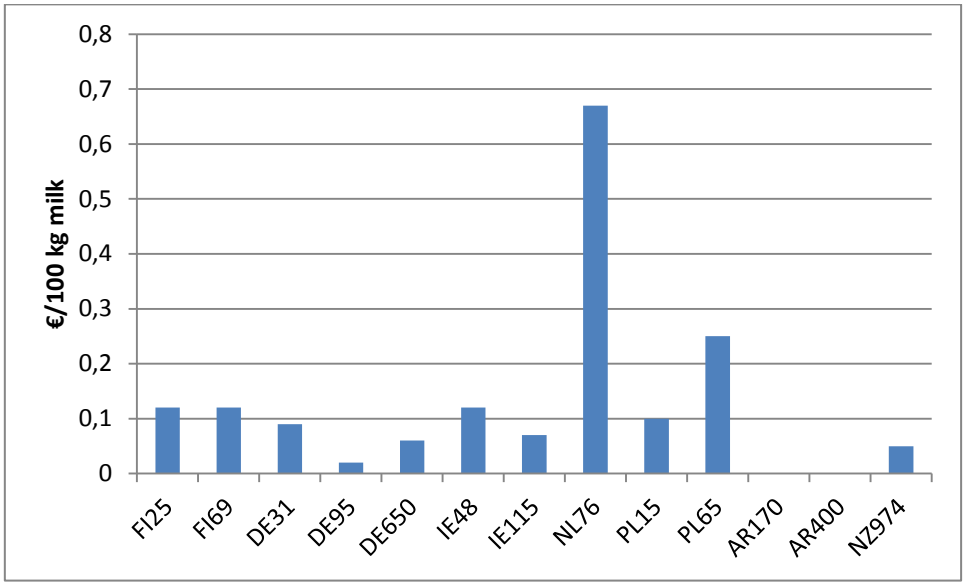
The aim of this section is to analyse the cost of compliance with legislation clustered in the three groups “the environment”, “animal welfare”, and “food safety” for the typical farms studied. In the following three tables which respectively refer to the environment, animal welfare, and food safety, entries show the absolute values of the base scenario (with legislation) and the scenario without legislation, as well as the absolute difference and the percentage change with respect to the base situation for each typical farm. The three charts shown are built upon the former value, showing the total compliance costs that typical farmers faced due to environment, animal welfare, and food safety legislations, respectively.

Table 4.9 – Costs of compliance with environment legislation for milk in selected countries

environment		unit	base	without	difference	% change
Finland	FI25	€/100 kg milk	75.05	74.93	0.12	0.16
	FI69	€/100 kg milk	70.15	70.03	0.12	0.16
Germany	DE31	€/100 kg milk	65.35	65.26	0.09	0.15
	DE95	€/100 kg milk	35.00	34.98	0.02	0.04
	DE650	€/100 kg milk	34.72	34.66	0.06	0.16
Ireland	IE48	€/100 kg milk	31.04	30.92	0.12	0.40
	IE115	€/100 kg milk	26.71	26.64	0.07	0.27
Netherlands	NL76	€/100 kg milk	41.96	41.29	0.67	1.61
Poland	PL15	€/100 kg milk	40.66	40.56	0.10	0.24
	PL65	€/100 kg milk	37.68	37.43	0.25	0.64
Argentina	AR170	€/100 kg milk	19.95	19.95	0.00	0.00
	AR400	€/100 kg milk	22.16	22.16	0.00	0.00
New Zealand	NZ974	€/100 kg milk	23.19	23.13	0.05	0.24

Own calculation

Figure 4.2 – Costs of compliance with environment legislation for milk in selected countries



Own calculation

The Nitrate Directive affected typical farms in all selected EU member states. On most farms, the costs are around 0.1 €/100 kg milk and are mainly due to additional storage facilities. The Netherlands, is the only country with higher costs (just below 0.7 €/100 kg milk). In this country, a very intensive production system is operated where land is the limiting factor. Therefore the upper limit of nitrogen per ha of land as required in the Nitrate Directive including the derogation, causes additional costs for excess slurry transport. The two Third Countries Argentina and New Zealand both mainly practice grazing. Only New Zealand has some regulations regarding the protection of

streams, rivers and groundwater from nitrogen pollution and the costs from that were comparable with the EU-farms in the lower cost range.

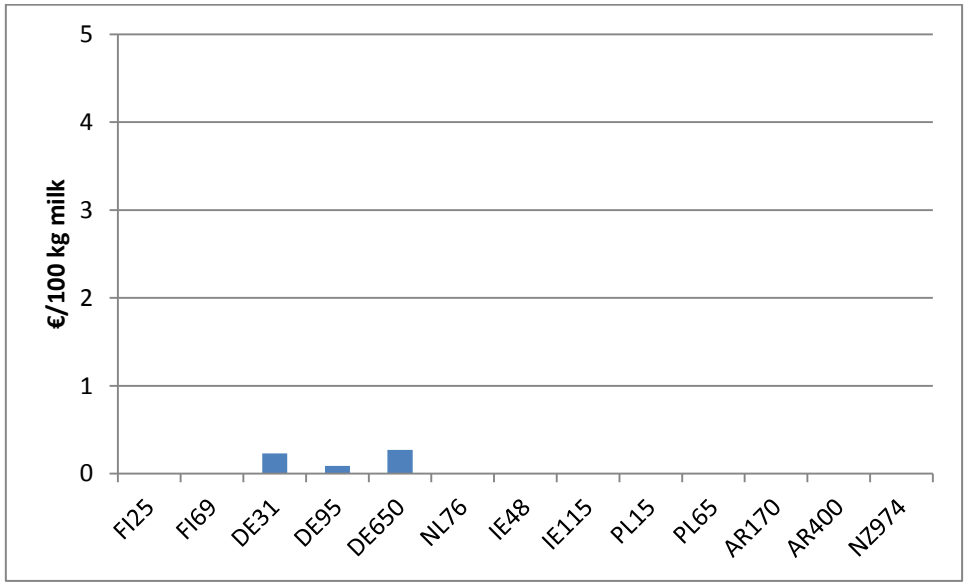
A special note needs to be dedicated to the implementation of the Nitrate Directive in Poland, in order to avoid confusion in the comparative analysis. Investments to comply with the slurry storage requirement (which was set to 4 months) were already undertaken between 2004 and 2007. This was due to pressures from international processors as well as public subsidies extending between 40% and 75% of the total cost. Therefore, though the actual implementation of the directive in 2010 classified only 2% of the territory as NVZ and most farms are not located within it, the investment still represents a relevant cost of compliance with the directive. Besides, the current infringement procedure of the European Commission against Poland is likely to result in a revision of the extension of the NVZs, in which case farmers that have already invested in slurry storage will already be compliant.

Table 4.10 – Costs of compliance with animal welfare legislation for milk in selected countries

animal welfare		unit	base	without	difference	% change
Finland	FI25	€/100 kg milk	75.05	75.05	0.00	0.00
	FI69	€/100 kg milk	70.15	70.15	0.00	0.00
Germany	DE31	€/100 kg milk	65.35	65.12	0.23	0.36
	DE95	€/100 kg milk	35.00	34.91	0.09	0.26
	DE650	€/100 kg milk	34.72	34.45	0.27	0.78
Ireland	IE48	€/100 kg milk	31.04	31.04	0.00	0.00
	IE115	€/100 kg milk	26.71	26.71	0.00	0.00
Netherlands	NL76	€/100 kg milk	41.96	41.96	0.00	0.00
Poland	PL15	€/100 kg milk	40.66	40.66	0.00	0.00
	PL65	€/100 kg milk	37.68	37.68	0.00	0.00
Argentina	AR170	€/100 kg milk	19.95	19.95	0.00	0.00
	AR400	€/100 kg milk	22.16	22.16	0.00	0.00
New Zealand	NZ974	€/100 kg milk	23.18	23.18	0.00	0.00

Own calculation

Figure 4.3 – Costs of compliance with animal welfare legislation for milk in selected countries



Own calculation

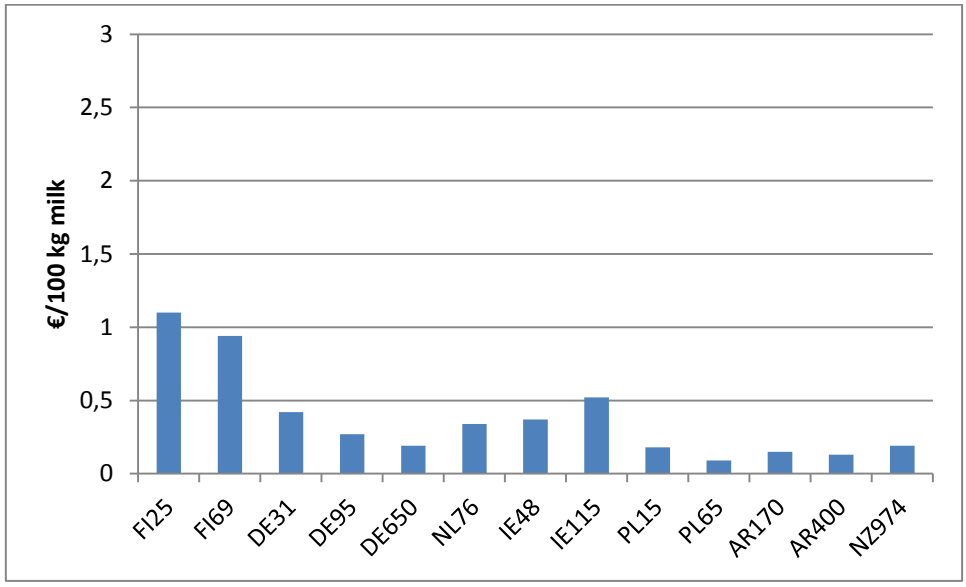
The directive regarding animal welfare describes the protection of calves. This directive sets the standards for calf housing. Germany is the only country where farmers had to adjust their calf boxes and houses to the new standard required and therefore, faced some costs. In the other EU member states, these standards are either already followed (NL, FI, and IE) or the directive was not yet in place in 2010 (PL). In Argentina and New Zealand, young calves are traditionally group housed and turn out to pasture soon after birth. This practice is also required by the Animal Welfare Act in New Zealand.

Table 4.11 – Costs of compliance with food safety and animal health legislation for milk in selected countries

food safety		unit	base	without	difference	% change
Finland	FI25	€/100 kg milk	75.05	73.95	1.10	1.46
	FI69	€/100 kg milk	70.15	69.21	0.94	1.33
Germany	DE31	€/100 kg milk	65.35	64.94	0.42	0.64
	DE95	€/100 kg milk	35.00	34.72	0.27	0.78
	DE650	€/100 kg milk	34.72	34.53	0.19	0.55
Ireland	IE48	€/100 kg milk	31.04	30.70	0.34	1.12
	IE115	€/100 kg milk	26.71	26.34	0.37	1.37
Netherlands	NL76	€/100 kg milk	41.96	41.44	0.52	1.24
Poland	PL15	€/100 kg milk	40.66	40.48	0.18	0.44
	PL65	€/100 kg milk	37.68	37.59	0.09	0.24
Argentina	AR170	€/100 kg milk	19.95	19.8	0.15	0.79
	AR400	€/100 kg milk	22.16	22.03	0.13	0.58
New Zealand	NZ974	€/100 kg milk	23.18	22.99	0.19	0.82

Own calculation

Figure 4.4 – Costs of compliance with food safety and animal health legislation for milk in selected countries



Own calculation

Various types of regulations and directives belong to the food safety category. The different groups are described earlier in this chapter. The highest costs per 100 kg milk are experienced in Finland as these farmers invested in shower facilities in order to prevent spreading of zoonotic agents and other diseases from spreading. The prevention of diseases is regulated through directives. This means the goals are common for all countries, but countries can decide how to achieve them. In the other countries involved in this study, the risk of a contamination through staff is not considered likely and therefore, these investments are not imposed. In Germany, Ireland, and the Netherlands, costs vary between 0.2 and 0.5 €/100 kg milk. In Poland, only the regulation regarding the identification and registration of animals was in force in 2010, therefore costs are low, but are expected to rise as soon as more regulations followed. New Zealand and Argentina have similar rules, mainly with regards to the identification of animals and prevention of diseases, but all in all, costs there are less than 0.2 €/100 kg milk.

The table and figure that follow offer a more detailed comparison between the environment, animal welfare, and food safety areas, in terms of percentage change with respect to the base situation. Food safety was split up into six groups as described earlier.

In Finland, Germany and Ireland the total percentage of costs of compliance vary between 1% and 1.5% in comparison with the base situation. The percentage is nearly twice as high in the Netherlands due to the nitrate directive, as explained earlier. Poland, New Zealand, and Argentina were at the same level between approximately 0.5% and 1%. In Poland, EU regulations have been introduced gradually, and in the reference year 2010, only the nitrate directive and the regulation on

identification and registration of animals were in place. Costs of compliance are expected to increase further with more EU regulations coming into force, for example (Regulation (EC) 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority, and laying down procedures in matter of food safety) was already scheduled to come in force in January 2011 (see table 4.7).

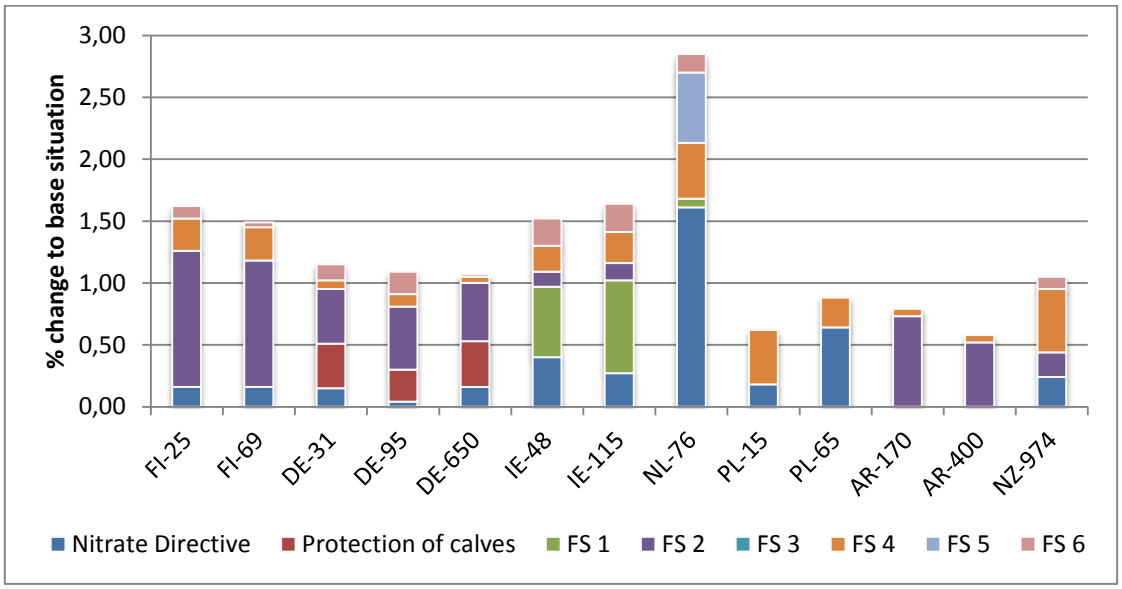
In Argentina and New Zealand, only some of the EU regulations have equivalent laws and therefore compliance costs are low.

Table 4.12 – Comparison of percentage change to base by normative area: milk

	Nitrate Directive	Protection of calves	Food safety 1	Food safety 2	Food safety 4	Food safety 5	Food safety 6	TOTAL
FI25	0.16	0.00	0.00	1.10	0.26	0.00	0.10	1.62
FI69	0.16	0.00	0.00	1.02	0.27	0.00	0.04	1.49
DE31	0.15	0.36	0.00	0.44	0.07	0.00	0.13	1.15
DE95	0.04	0.26	0.00	0.51	0.10	0.00	0.18	1.09
DE650	0.16	0.78	0.00	0.46	0.05	0.00	0.02	1.47
IE48	0.40	0.00	0.57	0.12	0.21	0.00	0.22	1.52
IE115	0.27	0.00	0.75	0.14	0.25	0.00	0.23	1.64
NL76	1.61	0.00	0.07	0.00	0.45	0.57	0.15	2.85
PL15	0.24	0.00	0.00	0.00	0.44	0.00	0.00	0.68
PL65	0.64	0.00	0.00	0.00	0.24	0.00	0.00	0.88
AR170	0.00	0.00	0.00	0.73	0.06	0.00	0.00	0.79
AR400	0.00	0.00	0.00	0.52	0.06	0.00	0.00	0.58
NZ974	0.24	0.00	0.00	0.20	0.51	0.00	0.10	1.06

Own calculation

Figure 4.5 – Comparison of percentage change to base by legislative area: milk



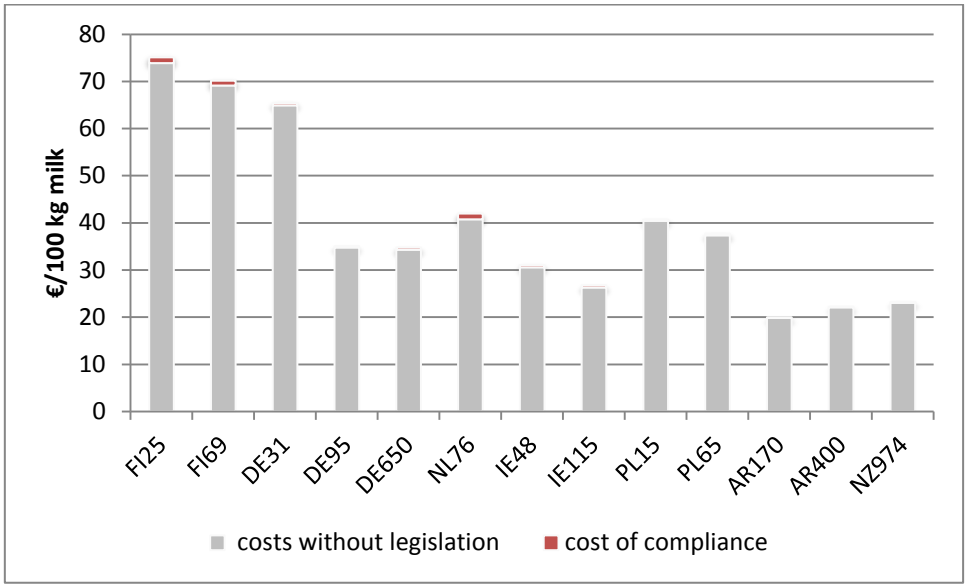
Own calculation

Only a few regulations cause costs of more than 1% of base costs. These are namely the Nitrate Directive (ENV) in the Netherlands and the prevention of diseases (FS2) in Finland. All other regulations have an impact of less than 1% and in many cases even less than 0.5% on total costs.

Figure 4.5 shows the total percentage change in all countries, as described before. It also shows the influence of the different regulations or groups of regulations on the base costs. The pattern is similar in farms of the same country, but different between different countries. This shows that although the regulations and directives are the same for all EU member states, the interpretation and enforcement of the latter are different at the country level and adjusted in a stricter sense to national conditions.

When comparing EU member states with Third Countries, the percentage of compliance costs are lower in the Third countries. The absolute height of the production costs in the base scenario should also be considered when assessing the impact of the regulations.

Figure 4.6 – Comparison of production and compliance costs for milk



Own elaboration

In Figure 4.5, the cost of compliance are presented in relative terms, whereas in Figure 4.6 absolute levels are shown. The latter chart compares the total cost with and without legislation for the typical dairy farms. Both Finland and the Netherlands have compliance costs of more than 1 €/100 kg milk either due to high production costs (Finland) or high percentage of compliance costs (the Netherlands). In Germany and Ireland, compliance costs run up to 0.4 to 0.5 €/100 kg milk. Poland and New Zealand face costs between 0.25 €/100 kg and 0.35 €/100 kg. The percentage of compliance costs is low in Poland because of the reasons mentioned above and production costs are

low in New Zealand. Argentina experiences low production costs and a low level of compliance costs and therefore, the absolute costs of compliance are less than 0.2 €/100 kg milk.

Within a country, the same legislation affects the different farm types, as can be seen from the colour pattern in Figure 4.5.However, they are not affected to the same extent. (Dis-)Economies of scale or different approaches on how to comply with a specific legislation, (e.g. the directive on protection of calves in Germany), cause different compliance costs per production unit. These differences are well captured by the selection of typical farms in the individual countries.

When looking at the results of this study, we must ask ourselves why the costs of compliance are limited and in most cases less than two percent of the total costs, compared to other cost factors. Historically, change in milk production systems and methodology and its legislation developed concurrently. A certain production method was predominant in a country, which was moderated, controlled and fine-tuned by legislation. New developments in the production system were accompanied by respective changes in the legislation in due time. Besides, the legislator has more flexibility in the applications of directives, which are legislative acts that set out a goal that all EU Member States must achieve. However, it is up to the national authorities to decide how to reach this goal. This concept was explained with the help of the Nitrate Directive earlier in the document. It has the advantage of taking into account special national circumstances so adjustments can be made as smoothly as possible. Furthermore, major changes affecting long term investments in new housing systems are announced well in advance and allow a long transition period. In this way, by the time, the new legislation is full in force, farmers have already adapted to the new system and it has become the framework to work with. Thus, any costs arising from the adjustments are not necessarily considered as compliance costs, but are regarded as general investments and farm development. Technological change and innovation are intermingled with changes in legislation. Other regulations, (e.g. hygiene rules for food of animal origin), only legalise what has already been standard due to requirements by the processing industry.

Compliance costs differ in the different Member States, and these differences might be larger between Member States than between Member States and Third Countries. This is primarily due to differences in farm structure between Member States and the degree of adaptation to legislation. Also many Third Countries face comprehensive legislation. Countries that are global players tend to be more regulated than countries that do not play a role on the world market. In this study, all countries involved require the identification and registration of bovine animals and rules are very similar across the countries chosen. Yet, the costs of compliance vary between 0.05 and 0.51% of the total production costs or 0.01 and 0.19 €/100 kg milk. These differences are due to different

input costs of the ear tags, the costs for the use of the herd registration programs, labour wages per hour and also the time taken to fulfil this work in the specific production system.

As demonstrated in Figure 4.6, production costs vary greatly between the countries participating in this study, and the compliance costs of less than two percent do not have a major impact on the competitiveness of milk production. Main cost factors are labour and non-factor costs, especially feed (see Figure 4.1). These, in turn, are dependent on the production system. For example, a housing system in the north of Europe dependent on ample storage facilities for slurry, requires more labour input and faces higher building and feeding costs per production unit than a grazing system in a moderate climate. So, optimising and stream-lining the production system by increasing labour or feed efficiency by ten percent has a higher impact on the cost structure and thus competitiveness than the compliance costs.

The discussion about the cost of compliance in the dairy case studies should also be considered in light of the benefits experienced. Society and the subsequent actors in the supply chain have greatly benefitted from food safety legislation. This legislation certainly has increased the reliability and competitive position of EU dairy products on the world market.

4.2. Case study: Beef meat

4.2.1. Choice of countries

In order to represent all the different aspects of the beef sector of the European Union, three member countries with different characteristics were chosen. Moreover, two Third Countries were selected as well for comparison purposes. On the basis of the criteria illustrated in section 1.3.3, the countries investigated for the beef sector are: France, Italy, the United Kingdom, Argentina and Brazil. These countries rank among the top 45 beef and buffalo meat producers in the world in terms of tonnes produced in the year 2010 (FAOSTAT 2012).

In France, a grass and maize silage based system is typical of the intensive conventional farm with its high intensity finishing process. The dressing percentage (carcass weight divided by live weight in per cent) is high in France. The climate is wet all season with an average annual temperature of 11 degrees. Italy, in the South of Europe, has extensive farming systems for beef and a moderately warm climate. In the United Kingdom the climate is mild and grazing is possible for most of the year. The second largest beef producing country in the world is Brazil. The farms are based on year-round grazing, little input and low production costs. The other Third Country included in this study is Argentina, a country predominantly applying a grazing system, but with a higher input in comparison to Brazil in terms of concentrate feed. Due to the extensive farming system, the weight gains per day are low.

4.2.2. National farm structure

Table 4.13 presents the key variables that describe beef meat production in the countries selected for the case study.

The French beef herd counted 18.99 million head in 2011, of which 4.17 million head were suckler cows and 3.64 million head were feeder cattle. Total production in 2011 was estimated in 1.45 million tonnes of beef meat with an average of about 370 kg/head. More than 50% of holdings had a herd count of less than 30 head.

The Italian beef herd counted 5.89 million head in 2011, of which 390,000 head were suckler cows and 0.57 million head were feeder cattle. Italy produced 1 million tonnes of beef in 2011 and the country is a net importer of beef and live cattle, especially from France. In the year 2010, Italy had 55,110 holdings with male cattle between 1 and 2 years. Of the total, 45% of holdings kept male cattle and had a herd count of less than 20 head. Specialised finishing farms of more than 100 head

represented only 13.6% of the total number of finishing farms. The population of dairy cows amounts to 1.75 million animals.

The United Kingdom had a beef herd of 9.69 million head in 2010, of which 1.64 million head were suckler cows. The production of beef in the UK reached 937,000 tonnes in 2011, and the national rate results from a population of 3.15 million head. In the year 2010 the country counted 25,656 holdings keeping beef cows. Most farms fell in the first herd size class (1 to 9 head per holding but the next category (10 to 29 beef cows) is also numerous. The average in 2010 was found to be around 26 beef cows per holding.

Table 4.13 – General information on beef meat producing countries, 2010 and 2011

	unit	FR	IT	UK	EU27	AR	BR	World
Total cattle	million heads	18.99	5.89	9.68	89.39	51.81	190.70	1,456.15
Suckler cows	million heads	4.17	0.39	1.64		18.56	18.56	
Feeder cattle	million heads	3.64	0.57	n. a.		8.29	8.29	
Production	million heads	3.91	1.75	3.15		10.86	46.30	
Production	in 1,000 tons	1,450	1,000	937	8,086	2,497	9,445	65,737
Production	kg/head	371	281	297		230	204	
Number of farms	units	50,530[1, 3]	55,110[1]	25,656		na	na	
Average herd size	head	n.a.	n.a.	26		n.a.	64.1[2, 3]	
Currency		EUR	EUR	GBP	EUR	ARS	BRL	-
GNI per capita[14]	US$	34,970	31,930	35,590	-	n/a	10,980	-

[1] *keeping male cattle between 1 and 2 years of age*

[2] *incl. dairy cows*

[3] *2007 data*

Sources: ISTAT, EUROSTAT, FAOSTAT, GEB 2011, DEFRA, SENASA, MINAGRI, IBGE, CNPC, ABIEC, CEPEA

[14] Gross National Income (GNI) per capita is based on purchasing power parity (PPP). The indicator is calculated converting gross national income to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.

The Argentinian beef herd included 51.81 million head in 2011. The suckler cow herd amounted to 18.56 million head and the feeder cattle to 8.29 million head. Beef production in the country reached 2,497,000 tons, with an average production of around 230 kg/head.
The Brazilian beef herd counted 190.7 million total head of cattle, divided into 18.56 million suckler cows and 8.29 million feeder cattle. According to records, 9,445,000 tonnes of beef were produced in 2010 and the national rate yielded by 46.30 million head. The average production is estimated at around 204 kg/head. The average herd size per farm was 64.1 head, including dairy cows.

4.2.3. Typical farm structure

The analyses of compliance costs for the selected beef meat producers were conducted adopting an approach that theoretically defines a number of typical farms for each country. These farms result from a number of theoretical assumptions (discussed in the previous chapters), that serve the purposes of this study. These farms do not exist in reality.
Five countries were part of the beef studies: France, Italy, and the United Kingdom as Member States of the European Union, and Argentina and Brazil as examples of Third Countries. Three typical farms are described for Brazil, two for the United Kingdom and Argentina, while for France and Italy one farm was analysed for each country.
Following is a short description of the typical beef farms and their most important characteristics.

FR70: represents a large, semi-intensive family farm (1.5 labour units) in the Limousin region in France with 71 head of cattle sold per year. The breed is Limousin. The farm is 95 ha with 85% good grassland and crop areas. It also has a suckler-cow (cow-calf) enterprise. This farm has the highest carcass yield for young bulls (62%) compared to all other typical farms of the study.

IT910: represents an Italian farm in the Veneto region (northern Italy) with 910 head of cattle sold per year and is farmed using an indoor system. Calves are imported from France for finishing. Cash crops are produced on the farm as well as Charolais beef cattle. The farm owns 130 ha, but has to buy a large portion of its feed. It hires two labour units. This is the only farm where a significant amount of land is devoted to pasture for spreading (28 ha). The carcass yield for young bulls is quiet high on this farm (61%).

UK45: represents a family farm in Devon (south-western England), United Kingdom with 45 head of cattle sold per year. For both cow and calf, as well as for the finishing enterprise, the farm uses a Limousin cross-bred. All 200 ha of the farm are used as pastureland. Two hired labourers work on the farm. This farm has the lowest carcass yield for steers (52%) and heifers (51%).

UK750: represents a British farm in Oxfordshire with 750 head of cattle sold per year. In addition to the beef production, crops and forage are produced on the 170 ha farm. The farm finishes stocker cattle (backgrounders). Breeds are continental beef crosses. The farm hires one additional full-time worker.

AR40K: represents a farm in the Buenos Aires province of Argentina with 39,045 head of cattle sold per year. The farm uses a feedlot system for the cattle (Angus and crosses). 23 hired labourers are working on the farm. 100% of the total land (77 ha) is arable. Most of the feed is purchased.

AR600: represents an Argentinian family farm in the east of the Buenos Aires province with 637 head of cattle sold per year. The farm owns 2,000 ha which produces not only cattle, but also cows, calves and cash crops. The cattle (Angus) are kept on a year-round grazing system with some additional concentrate feed during finishing. Along with one family labourer, three hired labourers work on the farm.

BR600: represents a family farm in the traditional cattle region of Mato Grosso do Sul in Brazil with 1,809 animals (Nelore). It runs a cow-calf enterprise producing weaner calves for finishing on the farm. The total number of cattle sold per year is 600. The final weight of the animals is 500 kg and they are fattened in 28 months with a low daily weight gain of 363 g, due to the grazing system. The total pasture area is 900 ha. There are 3 employees on this beef finishing farm.

BR600B: represents a Brazilian family farm located in the growing Tocantins region. It sells nearly 600 head of cattle per year and is based on purchased weaners. The farm is specialised in beef finishing of the Nelore breed and has no other enterprise. Four full-time hired workers and one family member work on the farm. It owns 1,500 ha which are used only for grazing. Through the grazing system, the average daily weight gain is low (399 g/day) compared to the other farms.

BR1550: represents a recently established, seasonal feedlot farm in the centre of Brazil (Goiás) with 1,547 head of Nelore cattle sold per year. All 177 ha of the farm are arable land and most of them

are used to produce corn silage. This is the farm with the highest average daily weight gain (1,811 g/day) compared to all other farms.

Table 4.14 – Typical farms: key variables of the beef herd

	FR70	IT910	UK45	UK750	AR40K	AR600	BR600	BR600B	BR1550
Region	Limousin	Veneto	Devon	Oxfordshire	Buenos Aires	Cuenca del Salado	Mato Grosso do Sul	Araguaina, Tocantins	Goias
Type of farm	weaner + steer/heifer finisher	bull finisher	weaner + steer/heifer finisher	steer finisher	steer, bull and heifer finisher	weaner + steer/heifer finisher	steer finisher	steer finisher	steer finisher
Cattle sold/year	71	910	45	750	39,045	637	606	598	1,547
Finishing animals produced	bulls, cows, heifers	bulls	steers, heifers	steers, heifers	steers, bulls, heifers	steers, heifers	steers	steers	steers
Breed	Limousin	Charolais	Limousin cross	Continental beef crosses/ native	Angus & Crosses	Angus	Nelore	Nelore	Nelore
Animals origin	own, cow-calf	purchase cow-calf	own, cow-calf	purchase	purchase	own, cow-calf	purchase	cow-calf, purchase	own, cow-calf
Production system	young bulls indoor, heifers and cows mixed	indoor system	grazing and finishing on grass	finishing on grass and maize silage	feedlot	outdoor, grazing	grazing	grazing	feedlot
Average daily weight gain (g/day)	1,273	1,466	749/792	976 steers, 714-762 heifers	1,402-1,453	537	363	399	1,811
Less favoured area (EU)	yes	no	no	no	n.a.	n.a.	n.a.	n.a.	n.a.
Legal form [1]	FF	FF	FF	FF	BF	BF	FF	FF	BF
Hired labour units	-	2	2	1	23	4	3	4	4
Family labour units	2	2	1	2	2	0.5	1	1	-
Total land (ha)	95	130	200	170	77	2,000	900	1,500	177
Arable land (%)	14	90	0	42	100	30	0	0	100
Pastureland (%)	86	10	100	58	0	70	100	100	0

[1] *Legal form: FF = family farm business; BF = agribusiness farm*

Source: Own data, Agri-benchmark Beef and Sheep

4.2.4. Costs of production

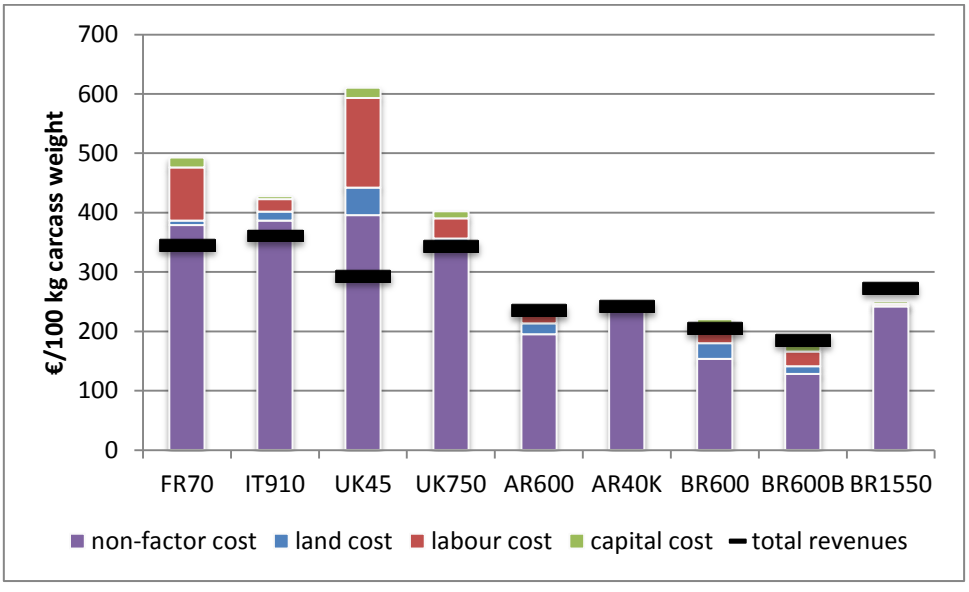
In the following table the production costs of the different countries are presented. The aim of this section is to compare the typical farms' total costs. The table thus shows the production costs and revenues in the year 2010. The costs are divided into land, labour, capital and non-factor costs. The product price is shown as well. The figure presents an overview of the total cost of production as well as the costs structure in the different countries analysed. The costs are shown as stacked bars, the sum of which represents the total cost level.

Table 4.15 – Beef meat production costs in selected countries, 2010

	unit	FR 70	IT 910	UK 45	UK 750	AR 600	AR 40K	BR 600	BR 600B	BR 1550
land cost	€/100 kg CW	7.6	15.1	46.2	10.8	18.7	0.2	26.1	12.9	0.6
labour cost	€/100 kg CW	89.5	21.4	150.7	34	16.8	3.8	28.2	25.2	3.6
capital cost	€/100 kg CW	16.6	4.8	17.4	11.5	6.1	0.7	12.3	12.7	4.3
non-factor cost	€/100 kg CW	378.9	386.2	395.8	345.5	194.8	238.6	153.6	127.9	241.8
total cost	€/100 kg CW	492.6	427.5	610.1	401.8	236.4	243.3	220.2	178.7	250.3
beef meat price	€/100 kg CW	345.0	358.1	293.1	343.7	234.8	224.2	204.9	185.2	268.7

Own calculation

Figure 4.7 – Beef meat production costs in selected countries, 2010



Own calculation

In general, land and capital costs account for only a minor portion of the total costs. Labour costs are high in France and in one of the two British farms in comparison to the other farms. The largest

portion of costs is the non-factor costs and among these, animal purchase costs as well as feed related costs typically represent the highest proportion. Farms classified as feedlots (AR40K and BR1550) have very low factor costs as land and capital costs due to their size and their main costs consist of animal and feed purchase. Long-term profitability (product price minus total costs) is low, especially on the European farms which cannot cover total costs with their returns.

The different level of production costs noticed in the previous figure (4.7) can be ascribed to a number of parameters which, together with those listed in section 1.3 "typical farm structure", constitute the major drivers.

In general, labour costs are higher in the European countries. The price for rented land varies among the countries and the farms. All farms have weaner[15] livestock, except UK750, BR1550 (only backgrounders[16]) and AR40K (weaners and backgrounders). Prices for livestock are lowest for the Third Country farms.

Table 4.16 – Production costs drivers: beef meat

cost item	FR70	IT910	UK45	UK 750	AR 600	AR 40K	BR 600	BR 600B	BR 1550
Labour (€/h)	13.3[17]	12.7	12.0	12.0	4.6	5.3	6.7	3.2	9.8
Land (rent) (€/ha)	87	563	164	181	119	224	37	11	35
Land productivity (kg CW/ha)	1,148	3,988	354	1,668	635	119,021[18]	141	87	6,182[4]
Livestock type	W	W	W	B	W	W, B	W	W	B
Livestock price (€/kg LW)	2.62	2.73	1.85	1.70	1.58	1.64	1.33	1.51	1.15
Concentrate price (€/t)	262[19]	289[5]	298	298[5]	272[5]	272	285	285[5]	285[5]
Mineral price (€/t)	543[5]	601	219	383	59[5]	59	403	632[5]	861

W = weaner; B = backgrounder

4.2.5. Selected legislation

The influence of the specific set of directives and regulations selected for the beef case study on the economics of beef production has been assessed for the following countries: France, Italy and the United Kingdom, as Member States of the EU; Argentina and Brazil, as Third Countries.

[15] Animal between 105 and 355 days coming from cow-calf.
[16] Animals between 4 and 15 months beyond the calf / weaner stage which had an initial fattening phase.
[17] This farm has only family labour, so the opportunity costs are given here; for the other farms paid wages are shown
[18] These farms are feedlots.
[19] Estimated price based on grains or concentrate and mineral prices from other typical farms in the *agri benchmark* sample. The farm does not feed concentrates/minerals.

The 15 directives and regulations were chosen and clustered into the three groups: the environment, animal welfare and food safety. Specifically, "the environment" (ENV) refers to the Nitrate Directive, and "animal welfare" (AW) is concerned with the welfare of calves. "food safety" (FS) covers aspects connected to a number of different areas: FS1 regulates the safety conditions at feed mills; FS2 tackles disease prevention, i.e. foot and mouth disease, bluetongue and zoonotic diseases; FS3 regulates the use of hormonal substances; FS4 covers the identification and registration of animals; FS5 describes measures aimed at the prevention of BSE; and FS6 encompasses regulations on the hygiene and traceability of foods of animal origin.

Two tables show the comparative analysis, which highlight respectively the actions required by each piece of legislation as well as the country where they are applied. They also show which legislation has the potential to generate a cost saving if it were not enforced.

4.2.5.1. Legislation requirements

Table 4.17 provides the list of the directives and regulations analysed (ENV, AW and FS), including the specifications of each law for each country. The list shows whether the norms are applicable to the countries individually and if and how they were transmitted into national legislation.

The two Third Countries are included in the comparison if their legislation is similar in content to the environmental, animal welfare and food safety areas of the EU-countries.

Table 4.17 – Specific normative requirements of selected legislation for beef production

code	legislation	FR	IT	UK	AR	BR
ENV	**Nitrate Directive (91/676/EEC)**					
	o Nitrate Vulnerable Zones (NVZ)	x	x	x	o	o
	o Ban on use of chemical fertiliser/manure in autumn and winter	x	x	x	o	o
	o Ban on N on water-logged or frozen ground	x	x	x	o	o
	o Buffer strips to water courses inside NVZ	x	x	x	o	o
	o Establish fertiliser planning	x	x	x	o	o
	o Establish farm-based nutrient balance	x	x	x	o	o
	o Min capacity for manure storage	x	x	x	o	o
	o Max level of N from manure (kg/ha/year)	170	170	170	o	o
	o Max level of fertiliser for each crop	o	x	x	o	o
	o Special spreading conditions	x	x	x	o	x
	o Special storage vessels for manure	x	x	x	o	o
	o Special equipment to avoid leakage/structural defects	o	o	o	o	o
	o Record application of fertiliser	x	x	x	o	o
	o Conditions for transport of excess manure	x	o	o	o	o
AW	**Directive on Protection of calves (2008/119/EC)**					

code	legislation	FR	IT	UK	AR	BR
	o avoid calf isolation after age of 8 weeks	x	x	x	o	o
	o min space for calves (except tether or muzzle calves)	x	x	x	o	o
	o daily inspection of calves (house calves at least twice daily)	x	x	x	o	o
	o keep animals with lights on (9am-5pm)	x	x	x	o	o
	o feed calves at least twice a day	x	x	x	o	o
	o sufficient iron in feed and minimum daily ration of fibrous food	x	x	x	o	o
	o use bovine colostrum after birth	x	x	x	o	o
	o calves shall not be muzzled	x	x	x	o	o
	o feed calves at same time when housed in groups	x	x	x	o	o
	o access to sufficient drinking water	x	x	x	o	o
	o minimise contamination of feed and water with suitable equipment	x	x	x	o	o
	o cleanable and not harmful accommodation and equipment	x	o	x	o	o
	o Requirements on air circulation, dust levels, temperature, relative air humidity and gas concentrations	x	x	x	o	o
	o daily inspection of mechanical equipment for calves	x	x	x	o	o
	o back-up system for artificial ventilation and regular testing	x	x	x	o	o
	o presence of suitable lighting for inspected calves	x	x	x	o	o
	o limitation of tethers	x	x	x	o	o
	o requirements on hygiene (cleaning and disinfection)	x	x	x	o	o
	o requirements on flooring (special bedding for young calves)	x	x	x	o	o
FS1	**Directive on Undesirable substances in animal feed (2002/32/EC)**					
	o Feed containing undesirable substances exceeding the maximum level set (Annex I) may not be mixed for dilution purposes	x	x	x	x	x
	o Complementary feeding stuffs shall not contain levels of undesirable substances (Annex I) exceeding those for complete feed stuffs	x	x	x	x	x
	o Ban on use of animal protein as feed for ruminants	x	x	x	x	x
	o Requirements for citrus pulp bran manufacturing	o	o	o	o	x
	Directive on Preparation, placing on the market and use of medicated feedstuff (90/167/EEC)					
	o Medicated feeding stuffs shall be manufactured from authorized medicated pre-mixes only	o	x	x	x	x
	o Medicated feeds must be prescribed, prepared and distributed by a vet/authority	x	o	o	x	x
	o Keep daily records of production and distribution	x	o	x	x	o
	o Requirements on production	o	x	x	x	x
	o Requirements on packaging	o	x	x	x	x
	o Requirements on labelling	o	x	x	x	x
	o Max residue limits for veterinary drugs in foods	x	x	x	x	x
	o Regulation for procedures of manufacturing and supplying of pesticides and veterinary medicines	o	x	x	x	x
	o Procedures for use, registration and commercialisation of additives	o	o	x	x	x
	Regulation on Feed hygiene (183/2005)					
	o Feed should not be contaminated	x	x	x	x	x
	o Hygiene of production	x	x	x	x	x

code	legislation	FR	IT	UK	AR	BR
	o Hygiene of packaging and distribution	x	x	x	x	x
	o Separate storage of hazardous materials	x	x	x	x	x
	o Keep records of measures put in place to control hazards	x	x	x	x	x
	o Source and use feed from registered establishments	x	x	x	x	x
	o Registration and approval system of feed businesses by national competent authorities	x	x	x	x	x
	Regulation on Additives for use in animal nutrition (1831/2003)					
	o Authorisation of a feed additive or its novel use	x	x	x	x	x
	o Registration of feed additives	x	x	x	x	x
	o Requirements on labelling and packaging	x	x	x	x	x
	Regulation on Placing on the market and use of feed (767/2009)					
	o Feed shall not contain or consist of materials whose placing on the market or use for animal nutrition is restricted or prohibited	x	x	x	x	x
	o Max level of feed additives in feed materials and complementary feed	x	x	x	x	x
	o Requirements on labelling, presentation and packaging	x	x	x	x	x
	o Requirements on placing on the market of specific types of feed	x	x	x	x	x
FS2	**Directive on Prevention of foot-and-mouth disease (2003/85/EC)**					
	o Bio-security: fences and truck baths	x	x	x	o	x
	o Screening tests, prevention and fighting schemes	x	x	x	x	x
	o Notify veterinary the (suspected) presence of the disease	x	x	x	x	x
	o Isolate animals, ban on movement, disinfection, destruction of carcasses	x	x	x	x	x
	o Measures to stop disease spreading, provide all necessary documents, sampling, slaughter animals, protected areas	x	x	x	x	x
	o Emergency vaccination	x	x	x	x	x
	Directive on Prevention of bluetongue (2000/75/EC)					
	o Screening tests, prevention and fighting schemes	x	x	x	x	o
	o Notify veterinary the (suspected) presence of the disease	x	x	x	x	o
	o Isolate of animals, ban of movement, disinfection, destruction of carcasses	x	x	x	x	o
	o Measures to stop disease spreading, provide all necessary documents, sampling, slaughter animals, protected areas	x	x	x	x	o
	o Treatments of animals with insecticide	x	x	x	x	o
	o Vaccination	x	o	o	o	o
	Directive on Monitoring of zoonoses and zoonotic agents (2003/99/EC)					
	o Collect relevant and comparable data to identify and characterise hazards	x	o	x	x	x
	o Monitor farms and slaughterhouses	x	x	o	x	x
	o Proper identification of samples	x	o	o	x	x
	o Regular tests	x	o	o	o	x
	o Keep records and report on results of analysis	x	x	o	x	x
	o Quarantine facilities	o	o	o	o	x
	o Protective clothes and shoes for visitors	o	o	o	o	x

code	legislation	FR	IT	UK	AR	BR
	o Shower facilities for staff	o	o	o	o	x
	o Disposal of dead animals at a knackery	x	o	o	o	x
	o Vaccination (leptospirosis, brucellosis, tuberculosis)	o	o	o	x	x
FS3	**Directive on Prohibition of hormonal substances (96/22/EC)**					
	o Ban on use of BST in feed	x	x	x	x	x
	o Ban on keeping substances with anabolic effect	x	x	x	x	x
	o Ban on feeding animals substance with anabolic effect	x	x	x	x	x
	o Ban on marketing treated animals or products derived therefrom	x	x	x	x	x
	o Ban on marketing of stilbenes, beta-antagonists and thyrostatic substances	x	x	x	x	x
	o Requirements on use of hormonal products and beta-antagonists	x	x	x	x	x
	o Requirements on import, manufacture, storage, distribution and use of hormonal products and beta-antagonists	x	x	x	x	x
FS4	**Regulation on Identification and registration of bovine animals (1760/2000)**					
	o transported animals must be accompanied by passport	x	x	x	x	x
	o record animal movements	x	x	x	x	x
	o tag animals (2 permanent ear tags)	x	x	x	x	x
	o update farm register	x	x	x	x	x
FS5	**Regulation on Prevention of TSE (999/2001)**					
	o ban on feeding protein derived from mammals	x	x	x	x	x
	o notify authority of the (suspected) presence of TSE infection	x	x	x	x	o
	o culling of infected animals and movement restrictions in case of outbreak	x	x	x	x	o
	o training in clinical signs and epidemiology	x	x	x	o	o
FS6	**Regulation on General principles of food laws (178/2002)**					
	o must place safe products on the market	x	x	x	x	x
	o responsibility for safety of food/feed produced, stored and sold	x	x	x	x	x
	o ability to identify from whom food/feed/food producing animals are received and to whom products are supplied	x	x	x	x	x
	o notify authorities in case of handling of food/feed held unsafely and collaborate to reduce risks	x	x	x	x	x
	o must withdraw from the market/not-use unsafe food or feed	x	x	x	x	x
	o hygienic standards	o	o	o	x	x
	o regulations for inspection	o	o	o	x	x
	Regulation on Traceability requirements (931/2011)					
	o traceability requirements	x	x	x	x	o

Symbols: x = enforced in the country; o = no specific legislation

A. ENVIRONMENT

The **Nitrate Directive** (**91/676/EEC)** applies to all EU Member States and acts to prevent the contamination of the environment. In France the paragraph about "special equipment to avoid leakage" was not in the transposition of the Nitrate Directive, but included in another French legislation (ICPE: classified installations for environmental protection). Besides regulations on spreading conditions in Brazil, no comparable national legislation can be found in the Third Countries.

The aim of the Directive is the protection of ground- and surface water from the pollution caused by nitrates deriving from agricultural sources. It also encourages the adoption of good farming practices. Its implementation takes place through the establishment of Nitrate Vulnerable Zones (NVZs). If a territory is classified as a NVZ, the producer must comply with a NVZ Action Programme, which includes a number of measures.

- There is a general ban on the application of chemical fertilisers or manure during autumn and winter time. Organic manure or N fertilisers cannot be applied where the ground is waterlogged, flooded, frozen hard or covered with snow.
- Slurry storage facilities with sufficient capacity must be available to cater for the period when spreading is suspended, or alternative arrangements should be made.
- Crop requirement limits must be respected by not applying more N than a crop requires, taking into account elements like crop uptake, soil N supply excess winter rainfall, and plant or crop- available N from organic manures.
- N fertiliser and organic manures should be spread as evenly and accurately as possible. Furthermore they cannot be applied to steeply sloping fields and in a way that contaminates watercourses (organic manures cannot be applied within 10m of watercourses).
- Any material or fertiliser that contains N and is applied to the land must be included in the N fertiliser calculations. Producers must keep farm and field records on cropping, livestock numbers, N fertiliser usage and manure usage for a minimum of five years after the relevant activity has taken place.
- The Nitrate Directive, therefore, limits the stocking rate to < 170kg N/ha.

B. ANIMAL WELFARE

Only one directive (**Protection of calves**) regarding animal welfare is relevant within this context and applies to France, Italy and the United Kingdom. This regulation regards the care and keeping of calves (i.e. minimum space allowance available to each calf, no isolation after the age of eight weeks, keeping calves with lights on from 9 am to 5 pm) and feeding regulations (i.e. sufficient quantities of iron in foodstuff) as well as hygienic requirements. There is no similar directive in the two Third Countries.

C. FOOD SAFETY AND ANIMAL HEALTH

There are six groups of food safety regulations considered in this study. The group "**Food Safety 1**" applies to France, Italy and the United Kingdom and contains five directives and regulations which directly affect feed mills. Costs concerning the feed mill industry may result in higher feed prices for the farm. Most aspects of the directives are also relevant for Argentina and Brazil.

The group "**Food Safety 2**" applies to France, Italy and the United Kingdom and contains three directives dealing with the prevention of diseases. Special measures have to be taken to prevent the outbreak of foot-and-mouth disease (a similar regulation also applies to Argentina and Brazil). The most important measures established by the regulations are:

- The presence or the suspected presence of food-and-mouth disease has to be reported to the competent authority without delay and the animals which are infected, or are suspected to be infected, have to be kept away from other animals.
- No animal can enter or leave the holding. A census has to be made, and the number of dead animals and\or animals suspected of being infected and\or animals contaminated has to be recorded. Records of all animal products on the holding are to be made and kept.
- An epidemiological inquiry has to be carried out and, if necessary, a preventive eradication programme must be started. All the buildings, their surroundings and all vehicles have to be cleaned and disinfected.

The prevention of bluetongue disease implies the following aspects. In the UK the Bluetongue Regulations 2008 implements Council Directive 2000/75/EEC concerning the control and eradication of Bluetongue. Vaccination was on a voluntary basis although it was recommended for certain areas. On July 2011 Great Britain was officially declared bluetongue virus free. Since this date vaccination is prohibited unless an inactivated vaccine is used. Argentina also has regulations

regarding bluetongue, while in Brazil the disease is not common, hence there is no specific legislation. Only the notification of suspected infection is mandatory.

- The presence or the suspected presence of bluetongue disease has to be reported to the competent authority without delay. The veterinarian must immediately implement official methods of investigation to confirm or rule out the presence of the disease.
- The carcasses of dead animals at the holding are to be destroyed or buried according to veterinary rules. When the presence of bluetongue is officially confirmed, further measures have to be taken, such as the implementation of protection zones.

To control zoonoses and zoonotic agents**,** monitoring activities have to be implemented (to a certain extent, this point is relevant for Argentina and Brazil as well):

- In case of zoonoses, samples have to be taken and analysed by a laboratory. Results have to be stored for at least 2 years.
- Dead animals have to be disposed of by means of an authorised knackery.
- Exchange of information is sought. Yearly reports by the Member States have to be sent to the Commission. Reports must include an account of the laboratory methodologies used for the identification of resistance and for the identification of microbial isolation, together with the methods used for data collection.

The group "**Food Safety 3**" applies to France, Italy, the United Kingdom, Argentina and Brazil and contains one directive. This directive prohibits the use of hormonal substances. The administration of the following substances to farm animals is prohibited: thyrostatic substances, stilbenes, stilbene derivatives, their salts and esters, oestradioal 17ß and its ester-like derivatives, as well as beta-agonists.

The group "**Food Safety 4**" applies to France, Italy, the United Kingdom, Argentina and Brazil and contains only one regulation. This regulation deals with the identification and registration of bovine animals. The animals have to be identified with 2 ear tags. Lost or damaged ear tags need to be replaced. Animals leaving the farm must be accompanied by their passport. Furthermore, an individual register must be kept on each holding and has to be up-to-date. A computerized database shall be set up by the Member States. Farmers shall notify to the central data base for births, deaths and animal movements within a specific time limit.

The group "**Food Safety 5**" applies to France, Italy and the United Kingdom and in some parts to Argentina and Brazil (although Brazil is free of this disease) as well. It contains one regulation dealing with the prevention of TSE. The feeding of protein derived from mammals can cause TSE. Consequently, it is prohibited to feed cattle with these proteins. Furthermore, specific risk material shall be removed and destroyed. When a TSE infection is suspected, the responsible authority has to be notified. Infected living animals and products of animal origin have to be kept apart from other animals and products. Training in the recognition of clinical signs and in epidemiology is organised for beef producers. Annual sample tests must take place.

The group "**Food Safety 6**" applies to France, Italy and the United Kingdom and contains two regulations, which are also relevant for both Third Countries. These directives comprise food law and traceability requirements. The regulation 'General principles and requirements of food law' has affects Brazilian farms to some extent. The Brazilian regulation Law N° 12.097, 24/11/2009 is a legislation of traceability but the adherence to the system is voluntary, but becomes compulsory when the product has to be exported to EU countries. This is why it was taken into account in this study. In order to achieve the general objective of a high level of protection of human health and life, food law is based on risk analysis and the precautionary principle shall apply. The traceability requirements regarding food of animal origin establish that this food must be accompanied by an accurate description, including the volume and quantity of the food, the name and address of the food business operator or consigner (owner) from which the food has been dispatched, and by a reference identifying the lot and the date of dispatch. The impact of this regulation was addressed in the section describing the regulation-costs for feed producing companies.

For the purposes of a sound comparative analysis of the competitive situation between the selected EU and Third Countries, state-specific legislations for the latter need to be considered, otherwise the cost of compliance could be underestimated. Therefore, measures which cause significant costs, and affect a majority of the national enterprises, are included in the calculations. Estimation is provided, which quantifies the cost impact in a situation where said Third Country specific legislations are not accounted for. The table shows the change in total costs if those country-specific regulations were not enforced, for each affected farm separately.

4.2.5.2. Cost items list and potential impact at farm level by country

In the table below, the cost items generated by the implementation of the legislation at farm level are listed. The detailed list is based on the information collected via the meetings with experts and

the panels carried out in each of the countries investigated. These meetings served as a basis to identify the real additional costs faced by farmers due to the legislation relevant to the beef industry. With regard to the symbols used in the table, the cross indicates in which country the specific cost item was identified as a compliance cost. For the Third Countries the legislations given in the table are the European one equivalent to the specific non EU legislation in the countries. The equivalent legislation for the Directive 91/676/EEC for Brazil is CONAMA Resolution n. 357/2005 and for the GAEC 2 it is the Law 4771/65,12. For Brazil the Regulation 396/2005 is similar to Resolution N° 901/2002 SENASA and Regulation 999/2001 is equivalent to SENASA Decree 4238/1968.

Table 4.18 – Comparison of legislative areas impacting cost of compliance in beef production

legislation		item	FR	IT	UK	AR	BR
ENV	Directive 91/676/EEC	manure for fertilising					x
	Directive 91/676/EEC	transport costs of pesticide packaging					x
	Directive 91/676/EEC	rented land		x			
	Directive 91/676/EEC	investment in manure storage capacity		x			
	Directive 91/676/EEC	record keeping system			x		
	Directive 91/676/EEC	spreading dirty water, effluent			x		
	Directive 91/676/EEC	storing shed for pesticides			x		
	Directive 91/676/EEC	fertilisation planning	x		x		
	GAEC 2 – Annex III of Regulation 73/2009	ha of PPA (Permanent Preservation Area): 10 m buffer strips along rivers					x
FS 1	Directive 2002/32/EC Regulation 183/2005	lower feed prices		x			
	Regulation 90/167/EEC	keeping a conventional day diary			x		
FS 2	Directive 2003/85/EC	vaccination/reduced vaccination	x				x
	Directive 2003/99/EC	biosecurity fence			x		
	Directive 2003/99/EC	burying animals on farm			x		
	Directive 2003/99/EC	quarantine housing (6 days still stand)			x		
FS 3	Directive 96/22/EC	use of compound feed with animal protein/beta-antagonists			x		x
FS 4	Regulation 1760/2000	use of ear tags	x	x	x	x	
	Regulation 1760/2000	passport for calves	x				
FS 5	Regulation 999/2001	sampling of food products			x		
	Regulation 396/2005	pesticides and chemical products				x	
	Regulation 999/2001	administrative work and sanitary control				x	
FS 6	Regulation 931/2011	registers for pesticide and traceability			x		

Symbols: x = identified as compliance cost

4.2.6. Costs of compliance comparison

This section analyses the costs of compliance for the selected farms with the legislation on the environment, animal welfare and food safety. The analysis does not detail the cost items used above for the comparative analysis of production costs, nor is revenue part of the picture at this point. Only the figures referring to total costs are shown here.

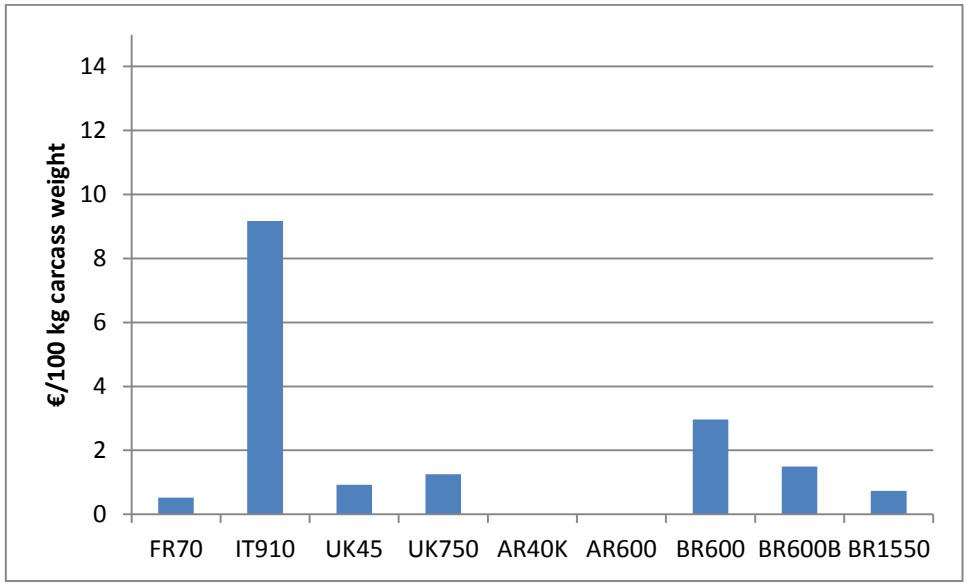
Table 4.19 reports the costs of compliance in the typical beef farms. In the tables, which respectively refer to environmental, animal welfare and food safety legislation, the absolute values of the base scenario ('with legislation') and the 'without' legislation scenario, as well as the absolute difference and the percentage of change with respect to the base situation are given for each typical farm. Figure 4.8 and Figure 4.10 depict the costs of compliance with environment legislation and food safety and animal health legislation in the selected countries.

Table 4.19 – Costs of compliance with environment legislation for beef in selected countries

environment		unit	base	without	difference	% change
France	FR70	€/100 kg CW	492.62	492.11	0.52	0.10
Italy	IT910	€/100 kg CW	427.50	418.34	9.17	2.14
United	UK45	€/100 kg CW	610.05	609.13	0.92	0.15
Kingdom	UK750	€/100 kg CW	401.79	400.54	1.25	0.31
Argentina	AR40K	€/100 kg CW	243.30	243.30	0.00	0.00
	AR600	€/100 kg CW	236.47	236.47	0.00	0.00
	BR600	€/100 kg CW	220.25	217.29	2.96	1.34
Brazil	BR600B	€/100 kg CW	178.64	177.15	1.49	0.83
	BR1550	€/100 kg CW	250.18	249.45	0.73	0.29

Own calculation

Figure 4.8 – Costs of compliance with environment legislation for beef in selected countries



Own calculation

The cost of compliance for the Nitrate Directive is the highest in Italy, although other European Member States are also affected by the regulation. There are two main reasons for the high costs in Italy. Due to the high animal stocking rates in some regions, the impact of the Directive at the time of its introduction was very high. The focus group claims farmers would return to the previous situation in the absence of the legislation. The Italian farm would pay for a permit to spread on additional 66 ha of land and would not invest in manure storage. The lowest cost effect can be found in France. In the Third Countries, only one Brazilian farm has higher costs due to the Brazilian legislation which corresponds to the Nitrate Directive.

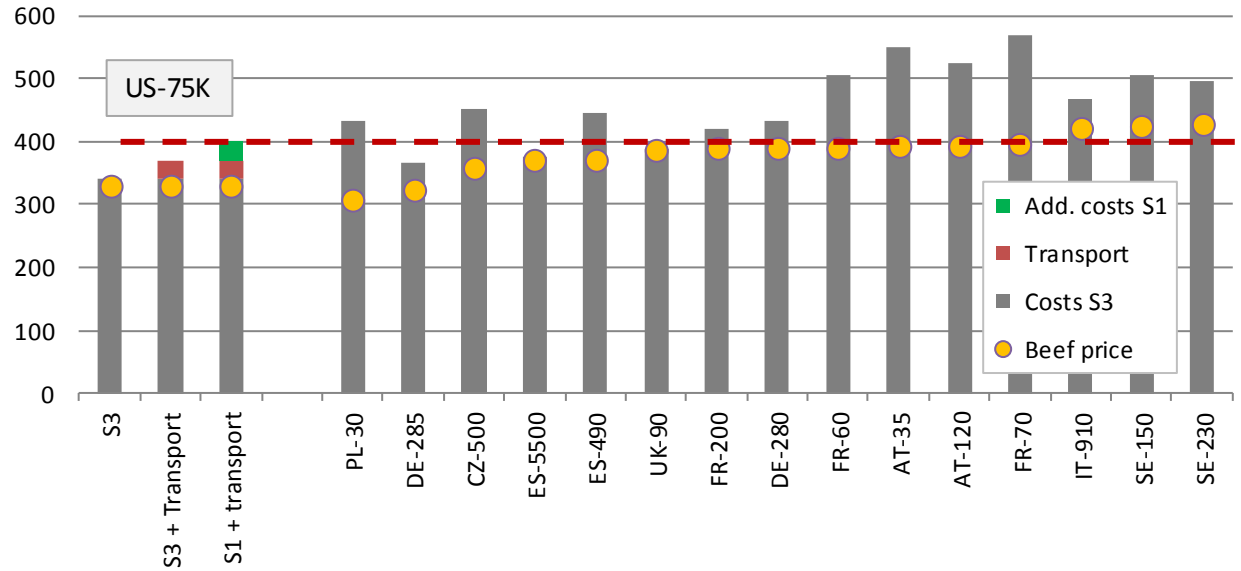
The "protection of calves" regulation specifies that calves under 6 months of age have to be kept on straw or on a concrete, non-slatted floor. As this is common practice in cow-calf operations where calves are either kept on pasture or in straw-bedded barns during wintertime, there is no cost implied for complying with the regulation in the farms analysed.

In the EU Member States, the cost of compliance with food safety legislation is highest for France (due to ear tags and passports for cattle and the prevention of the foot-and-mouth disease, e.g. storage of vaccination products). Since Brazilian legislation allows hormone use in beef production, the two typical farms (BR600 and BR1550) have to face extra cost in order to export meat to the EU because of the EU prohibition of using beta-antagonist. The other Brazilian typical farm

BR600B represents the beef farms using the grazing system where the use of hormones is not common practice, hence their compliance cost is not influenced by this food safety measure.

Another study has calculated the cost effects of hormone and beta-agonist free beef for a US farm for export to the EU.

Figure 4.9 – Cost and price differentials for Scenario 1 and 3 (including transport costs)



Source: Deblitz, Dhuyvetter (2013)

Figure 4.9 shows the cost and price differentials between the US farm and European farms for three scenarios: S3 is the status quo with hormones / beta-agonists: S3 + Transport: is the status quo plus transport from Nebraska to Europe (8-9% transport costs); S1 + Transport: is the situation without hormones / beta-agonists plus transport from Nebraska to Europe.

The costs per head in the 'without' scenario (S1) would be approximately between 26 € and 30 € per 100 kg CW higher than the current cost. Costs at arrival in Europe would rise to around 400 € per 100 kg CW. This would reduce the cost difference between US-75K and the EU farms further and US costs would come close to the cost levels of the lowest cost farms in the comparison.

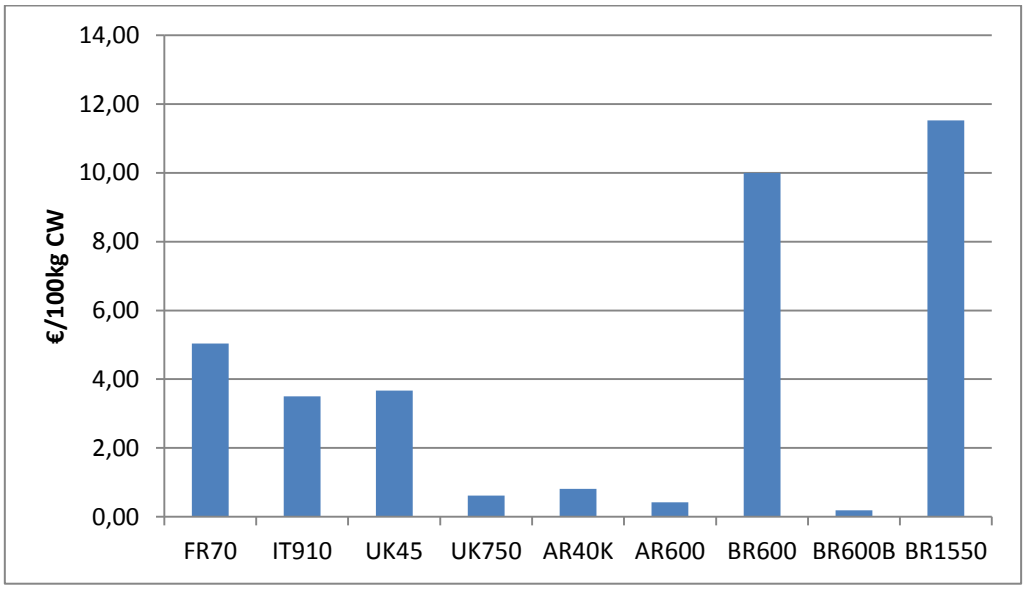
For BR600B, growth hormones and promoters are not relevant as the farming system on the farm is pasture.

Table 4.20 – Cost of compliance with food safety and animal health legislation for beef in selected countries

food safety		unit	base	without	difference	% change
France	FR70	€/100 kg CW	492.62	487.07	5.04	1.02
Italy	IT910	€/100 kg CW	427.50	424.00	3.50	0.82
United	UK45	€/100 kg CW	610.05	606.38	3.67	0.60
Kingdom	UK750	€/100 kg CW	401.79	401.17	0.62	0.15
Argentina	AR40K	€/100 kg CW	243.30	242.49	0.81	0.33
	AR600	€/100 kg CW	236.47	236.05	0.42	0.18
Brazil	BR600	€/100 kg CW	220.25	210.25	10.00	4.54
	BR600B	€/100 kg CW	178.64	178.45	0.19	0.11
	BR1550	€/100 kg CW	250.18	238.66	11.52	4.60

Own calculation

Figure 4.10 – Costs of compliance with food safety and animal health legislation for beef in selected countries



Own calculation

The preceding tables and figures describe the impact of the three normative areas considered in their entirety. However, they do not provide much information on the effect of a single piece of legislation on each specific country. This shortcoming is overcome through the table and the chart below, where the costs of compliance are separated into their components. Note that the table gives the percentage change of the 'without legislation' to the base scenario 2010.

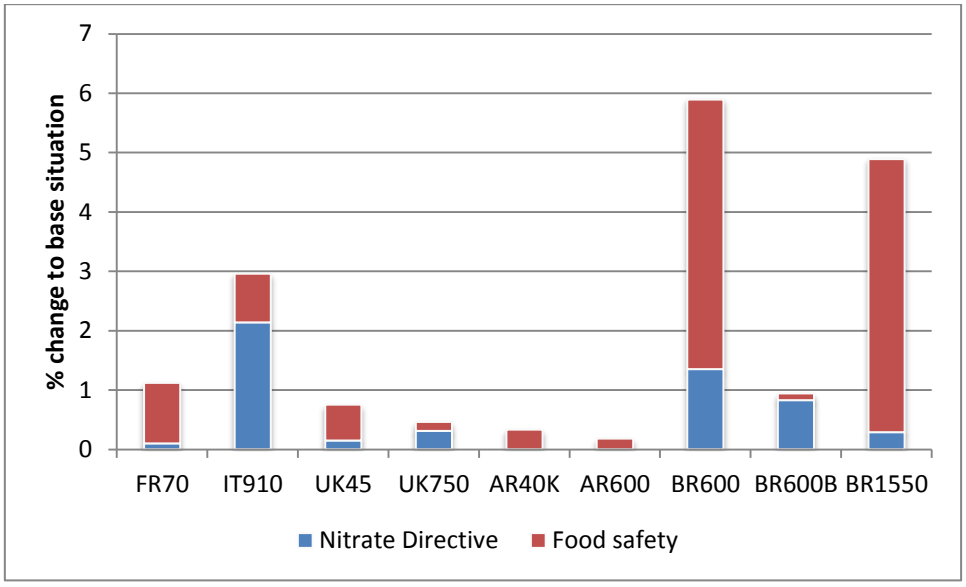
Table 4.21 – Comparison of percentage change to base by normative area: beef meat

	Nitrate Directive	Animal welfare	Food safety and animal health	TOTAL
FR70	0.10	0.00	1.02	1.13
IT910	2.14	0.00	0.82	2.97
UK45	0.15	0.00	0.60	0.75
UK750	0.31	0.00	0.15	0.46
AR40K	0.00	0.00	0.33	0.33
AR600	0.00	0.00	0.18	0.18
BR600	1.35	0.00	4.54	5.79
BR600B	0.83	0.00	0.11	0.94
BR1550	0.29	0.00	4.60	4.88

Own calculation

Among the directives selected for the beef case studies, it can be argued that the impact of animal welfare norms is generally negligible or absent. The Nitrate Directive is a cost factor in the EU, especially for Italy, Its comparable environmental measures are significant for Brazilian production as well. Finally, food safety legislation has a greater effect in Brazil than in the EU where the highest impact is registered by France.

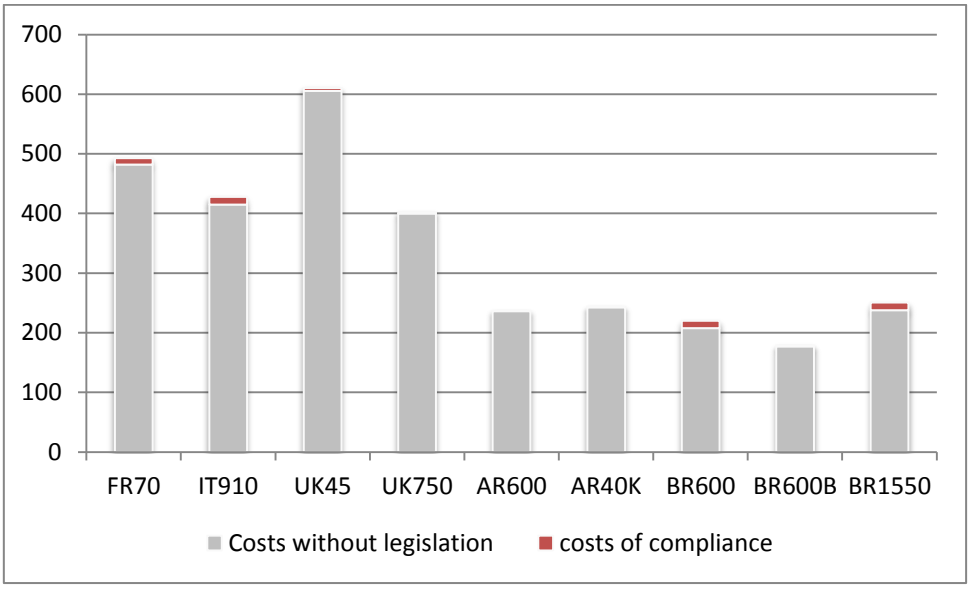
Figure 4.11 – Comparison of percentage change to base by normative area: beef meat



Own calculation

The figure below compares the total cost with and without legislation for the typical beef farms.

Figure 4.12 – Production and compliance costs of beef production



Own calculation

The selected legislation is applied to all farms within a country but not all farms are affected in the same way. In general the compliance costs are relatively low compared with total costs for the beef typical farms analysed and in the EU do not exceed 3% in any of the cases considered. This is due to the fact that most of the costs are driven by price and productivity levels which can be assumed to be widely independent from the regulations analysed in the first place. Non-factor costs are the highest costs (they are at least 65 percent of total costs for the beef enterprise for all farms) as they include purchase of animal and feed. The proportion of animal purchase in non-factor costs varies between 40 and 80 percent in the farms.

Other reasons why the compliance costs are relatively low are:

a) In some cases regulations have already been standard due to requirements by the processing industry, e.g. hygienic standards for food safety,

b) Some of the requirements regarding the prevention of diseases were already considered by the farms before the legislation was in place, as the farms do not want to be affected by these diseases.

In areas affecting other legislations the change in the production system and the implementation of the regulations developed simultaneously. A certain production method was predominant in a country, was then modified, controlled and fine-tuned by legislation. If there were new developments in the production system these were accompanied by new or changed legislations at the same time. As a consequence, changes and adjustments required by law had a limited effect on the costs of production in a given time period.

The reasons why compliance costs differ not only between EU Member States and Third Countries but also between Member States within the EU are due to the different farm structure like size and

number of animals, legal organisation and ownership, market arrangements under which farmers buy and sell, natural conditions and farming practices. (See also Tables 4.13 and 4.14). Farms with a higher number of animals often have lower costs per animals or produced kg meat for a specific legislation due to economies of scale. Another example is the high animal stocking rate in Italy which leads to a higher impact of the nitrate directive at the time of the introduction in comparison to the other typical farms in Europe. Furthermore there are different wage rates and different time requirements to comply with specific legislation in different production systems, resulting in different compliance costs.

The competitiveness of EU beef production is determined by the smaller herd size, higher labour and land costs and by the higher feed prices in comparison with the beef production in Argentina and Brazil. The compliance costs with legislation play a minor role to this respect.

4.3. Case study: Sheep meat

4.3.1. Choice of countries

In order to represent all the different aspects of the European Union's sheep sector, two member countries with different characteristics were chosen. Two Third Countries were selected as well for comparison purposes. On the basis of the selection criteria illustrated in section 1.3.3. The countries investigated are: France, the United Kingdom, Australia and New Zealand.

France specializes in big flocks on extensive grassland. The United Kingdom represents an extensive farming system in a temperate climate. One of the most intensive sheep-raising countries in the world is Australia, which predominantly applies a grazing system. The second Third Country is New Zealand, where farms are based on grazing all year round and little input. Consequently, production costs are low, and the sector is highly dependent on exports.

4.3.2. National farm structure

The countries investigated for the sheep sector rank among the top 45 sheep meat producing countries in the world in terms of tonnes produced in the year 2010 (FAOSTAT 2012).

Table 4.22 presents the key variables that describe sheep meat production in the countries selected for the case studies.

The French sheep herd amounted to 7.74 million head in 2011, and 114,000 tonnes of sheep meat were produced in the same year. The average slaughter weight was 18.8 kg. In 2010, France had 64,950 breeding ewe holdings. Many French farms keep sheep in small-sized flocks: in 2010, more than 50% of sheep farms had ewe flocks smaller than 50 head. As in other parts of the world, there is a trend towards a consolidation of the farms' number, entailing a reduction of the total number, and an increase in the average farm size (Deblitz, 2011).

The British sheep herd counted 21,951 million head in 2011, of which 14,485 were slaughtered in 2011, leading to a production of 290,000 tonnes of sheep meat in 2011. The average slaughter weight was 20 kg. Due to data availability constraints, the number of holdings with breeding ewes serves as an indicator for farm structure. In 2010, the United Kingdom had 67,730 breeding ewe holdings with an average flock size of 208 breeding animals. The total number of sheep holdings was higher and comprised farms without ewe enterprises, but with finishing lambs.

The Australian sheep herd counted 68.09 million head of sheep in 2010, and in the same year 541,000 tonnes of sheep meat were produced. The average slaughter weight was estimated at about

22 kg in 2010. In 2009/2010 Australia had 42,573 agricultural holdings keeping sheep or lambs. The average flock size was nearly 1,600 sheep or lambs per holding.

New Zealand had a sheep herd of 32.6 million head in 2010, of which 25.28 million head were slaughtered in 2010, yielding a production of 470,000 tonnes. The average slaughter weight was 18.6 kg in 2010. Regarding the farm size structure, data is only available for the year 2002, when 26,625 sheep keeping farms were registered. The average herd size was 1,486 animals.

Table 4.22 – General information on sheep meat producing countries, 2010 and 2011

	unit	FR	UK	EU27	AU	NZ	World
Total sheep	million heads	7.64	21.95	99.15	68.09	32.60	1,127.05
Slaughtering	million heads	5.54	14.49		24.70	25.28	
Sheep meat produced	1,000 tons	104	290	889.85	541	470	8,532
Average slaughter weight	kg	18.8	20		22	18.6	
Number of farms	units	64,950	67,730[1]		42,573[3]	26,625[4]	
Average herd size	heads	n.a.	208[2]		1,600[3]	1,487[4]	
Currency		EUR	GBP	EUR	AUD	NZD	-
GNI per capita[20]	$	34,970	35,590	-	37,580	28,310	-

[1] *holdings breeding ewes*

[2] *breeding animals*

[3] *year 2009/2010*

[4] *year 2002*

Sources: DEFRA. FAOSTAT, Australian Bureau of Statistics

4.3.3. Typical farms structure

The analyses of compliance costs for the selected sheep meat producers were conducted adopting an approach that theoretically defines a number of typical farms for each country. These farms result from a number of theoretical assumptions (discussed in chapters 2 and 3), that serve the purposes of this study. They do not exist in reality.

[20] Gross National Income (GNI) per capita is based on purchasing power parity (PPP). The indicator is calculated converting gross national income to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.

For all countries, two typical farms are described, except for New Zealand, where only one farm was set. A short description of the typical sheep farms and of their most important characteristics follows.

FR470s represents a French farm with 470 ewes with an indoor and outdoor grazing system. The breed is Vendéen and Rouge de l'Ouest. The farm also has a cash crop enterprise on its 105 ha. The French farms are the only ones which have a combined indoor and outdoor production system. This farm has the highest weaning weight (40 kg) compared to all other farms.

FR860s represents a large farm in France with 860 crossbred ewes. The sheep are kept both indoors and outdoors. The farm operates on 140 ha land (21% grassland) and also has sheep triticale for feed and sale. On average, the ewes have 3 lambings in 2 years, resulting in high lamb yields. The French farms are the only ones which have a combined indoor and outdoor production system. It has the highest lamb losses in comparison to the other farms (17 per cent).

UK400s represents a farm in the northwest of the United Kingdom with 400 ewes. The sheep (Swaledale) are raised outside. 82% of the total farm land (195 ha) is used for grazing. There is no other enterprise on the farm apart from sheep production. Only the farms in the United Kingdom completely devote their land to pasture. All other typical farms associate a mixture of arable land for crop production and pasture. It is located within a less favoured area. The farm ranks first regarding the number of weaned lambs per 100 ewes per year (151).

UK500s represents a farm with 500 ewes in the northeast of the United Kingdom. Other enterprises on the farm are a beef finishing and a cow-calf (suckler-cow) enterprise. The breed is Swaledale and the sheep are raised outdoors. 300 ha of the farm is grassland. This farm also has a cash enterprise. It is located within a less favoured area. This farm is the only European one which hires labour (one addition person working around 500h). Furthermore it has the highest weaning age (150 days) compared to all other farms.

AU2000s represents a farm with 2,000 ewes in the northwest of New South Wales in Australia. The dominant breeds are Merino and Merino-Border Leicester. Besides sheep production, cash crops are produced on the 2,000 ha farm. 35% of the farm land (700 ha) is used as grassland, while the remaining part is arable land where winter wheat, winter barley, winter rape, chickpeas and sorghum are produced. The legal form of the farm is a partnership. To manage the farm, one

additional fulltime worker is hired. This is the only farm which produces only male lambs, while all other farms produce both male and female lambs. Furthermore only 88 lambs per 100 ewes per year are weaned, which is the lowest number in comparison to all other farms. However, at the same time it has the lowest percentage of lamb losses when compared to the other farms (only 2 per cent). The weaning age on this farm is only 84 days which is the lowest in comparison to the other farms. The weaning weight is also the lowest with 26-27 kg.

AU3000s represents a larger family partnership farm in Western Victoria with 3,000 ewes. The breed is a cross of Coopworth-cross and Dorset. The farm owns 600 ha which are only used for an outdoor grazing system. There is no other enterprise. Half of the work is done by family members, the other half by casual workers and shearers. This farm hires one additional fulltime worker.

NZ3200s represents a farm on the eastern coast of New Zealand´s North Island. The sheep (Romney) are kept outdoors. On its 896 ha, the farm also has a cattle finishing enterprise (bull beef), a cash crop enterprise (winter rape and rye) and a forestry plantation. The legal form of the farm is a family partnership with trust-owned land.

Table 4.23 – Typical farms: key variables of the sheep herd

	FR470S	FR860S	UK400S	UK500S	AU2000S	AU3000S	NZ3200S
Region	Pays de la Loire	Poitou-Charentes	North West	North East	North West New South Wales	Western Victoria	East Coast North Island
Type of farm	ewe farm	ewe farm	ewe farm	ewe farm	ewe farm	ewe farm	ewe farm
Number of ewes	470	860	400	500	2,000	3,000	3,200
Lamb gender	female/male	female/male	female/male	female/male	male	female/male	female/male
Breed	Vendéen, Rouge de l'Ouest	Crossbred	Swaledale	Swaledale	Merino, Merino-Border Leicester	Coopworth Crosses × Dorset	Romney
Animal origin	own ewe	own ewe	own ewe	own ewe	own ewe	own ewe	own ewe
Weaned lambs/100 ewes/year	148	112	151	137	88	109	111
Lamb losses (%)	15	17	3	6	2	16	6
Weaning age (days)	90	90	88	150	84	112	106
Weaning weight (kg)	40	39	26/30	30	26-27	30	38-40
Legal form	Family Farm business	Family Farm business	Family Farm business	Family Farm business	Cooperative farms	Cooperative farms	Cooperative farms
Hired labour (hours)	-	-	-	1 (546 h)	1 (2,304 h)	1 (2,304 h)	-
Family labour (hours)	1.3 (2,400 h)	1.5 (2,500 h)	1 (3,120 h)	2 (4,724 h)	1 (2,448 h)	1 (2,304 h)	3 (4,335 h)
Production system	outdoor/indoor	outdoor/indoor	outdoor	outdoor	outdoor	outdoor	outdoor pasture
Total land (ha)	50	140	195	300	2,000	600	696
Share of arable land (%)	93	79	0	0	65	0	3
Share of pastureland (%)	7	21	100	100	35	100	97
Irrigation (%)	0	0	0	0	0	0	0

Source: Own data, Agri-benchmark Beef and Sheep

4.3.4. Cost of production

The production costs between the different countries are presented in the following table. The costs are divided into land, labour, capital and non-factor costs. The sheep meat price is also shown. The figure presents an overview of the total production costs as well as the costs structure in the different countries analysed. The costs are shown as stacked bars, the sum of which represents the total cost level.

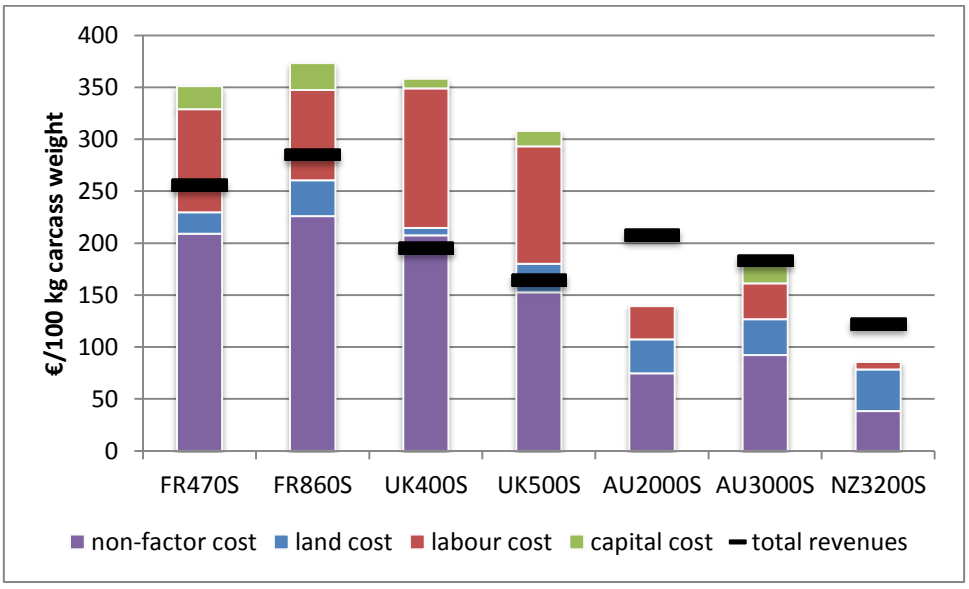
The aim of this section is to compare the typical farms in the 'with' situation. The table shows the actual production costs and revenues.

Table 4.24 – Sheep meat production costs in selected countries, 2010

	unit	FR 470S	FR 860S	UK 400S	UK 500S	AU 2000S	AU 3000S	NZ 3200S
land cost	€/100 kg LW	20.60	34.70	7.30	27.50	32.70	34.40	39.90
labour cost	€/100 kg LW	99.20	86.90	134.30	113.10	32.10	34.50	7.40
capital cost	€/100 kg LW	22.30	25.70	9.10	14.70	0.50	23.90	0.10
non-factor cost	€/100 kg LW	209.10	226	207.50	152.70	74.70	92.30	38.50
total cost	€/100 kg LW	351.20	373.30	358.20	308.00	140.00	185.10	85.90
sheep meat price	€/100 kg LW	219.80	234.20	126.26	155.95 [21]	169.50	155.60	104.50

Own calculation

Figure 4.13 – Sheep meat production costs in selected countries, 2010



Own calculation

[21] It is typical for the UK farms to sell the weaned lambs (store lambs) to another finishing farm for finishing (stratification system). However, the production of store lambs is the main product of the farms. Consequently, the receipts for store lambs were included in the sheep revenues for the two UK farms.

As the table and the chart show, land and capital costs generally account for only a minor portion of the total costs. Labour costs are higher in the European Member States than in the Third Countries. Non-factor costs represent the largest proportion of costs in nearly all countries. New Zealand is an exception as land costs constitute a major part of total costs. This is mainly due to the expansion of milk production and associated increases in land prices. As in sheep production, long-term profitability (total revenues minus total costs) is negative, while the Australian and New Zealand farms break even or even make a long-term profit.

The different level of production costs noticed in the previous figure can be ascribed to a number of parameters which, together with those listed in section 1.3.3, constitute the major drivers. In general, the labour costs (opportunity costs) in € per hour are higher in the Third Countries. The costs for rented land (in €/ha) vary between the farms and are highest in France and lowest in Australia.

Table 4.25 – Production costs drivers: sheep meat

cost item	FR 470S	FR 860S	UK 400S	UK 500S	AU 2000S	AU 3000S	NZ 3200S
Labour (opportunity costs) (€/h)	9.7	9.7	9.2	14.8	23.4	21.6	4.5
Land (rent) (€/ha)	121	101	100	61	40	83	136
Land productivity (kg LW/ha)	621	292	106	221	119	241	341
Concentrate price (€/t)	250	250	186	224	109	86	70
Mineral price (€/t)	531	531	738	615	550[1]	550[1]	500[1]

[1] *Estimated price based on grains or concentrate and minerals prices from other typical farms in the Agri-benchmark sample. The farm does not feed concentrates/minerals.*

Own elaboration

4.3.5. Selected legislation

The 10 directives and regulations were clustered into three groups: the environment, animal welfare and food safety. Specifically, “the environment” (ENV) refers to the Nitrate Directive, and “animal welfare” (AW) is concerned with the welfare and protection of animals kept for farming purposes. “Food safety” (FS) covers aspects connected to a number of different areas: FS1 regulates the safety conditions at feed mills; FS2 tackles disease prevention, i.e. foot-and-mouth disease, bluetongue and zoonotic diseases; and FS4 covers the identification and registration of animals.

The comparative analysis is developed in two tables, which indicate, respectively, the actions required by each piece of legislation, the country where they exist and are enforced and the areas where costs would be lower if the legislation did not exist or was not enforced.

4.3.5.1. *Legislation requirements*

Table 4.26 provides a list of the directives and regulations analysed (ENV, AW and FS) including the specifications of each piece of legislation for each country. The list shows whether the legislation is applicable to each of the countries and if and how they were transposed to the national legislation. The two Third Countries are included in the comparison if their legislation can be content-wise assigned to the environment, animal welfare and food safety areas of the EU Member States.

Table 4.26 – Specific normative requirements of selected legislation for sheep production

code	legislation	FR	UK	AU	NZ
ENV	**Nitrate Directive (91/676/EEC)**				
	o Nitrate Vulnerable Zones (NVZ)	x	x	o	o
	o Ban on use of chemical fertiliser/manure in autumn and winter	x	x	o	o
	o Ban on N on water-logged or frozen ground	x	x	o	o
	o Buffer strips to water courses inside NVZ	x	x	o	x
	o Establish fertiliser planning	x	x	x	x
	o Establish farm-based nutrient balance	x	x	x	x
	o Soil sampling	o	o	x	o
	o Min area covered with catch crops	o	o	o	o
	o Min capacity for manure storage	x	x	x	o
	o Max level of N from manure (kg/ha/year)	170	170	o	o
	o Max level of fertiliser for each crop	o	x	o	o
	o Special spreading conditions	x	x	x	x
	o Special storage vessels for manure	x	x	x	o
	o Special equipment to avoid leakage/structural defects	o	o	x	o
	o Record application of fertiliser	x	x	x	o
	o Conditions for transport of excess manure	x	o	o	o
	Habitat Directive 92/43/EEC				
	o damage caused by wild animals	o	o	x	o
	o predator species control	o	o	o	x
AW	**Directive on Protection of animals kept for farming purposes (98/58/EC)**				
	o *no specific requirements*	o	o	o	o
FS1	**Directive on Undesirable substances in animal feed (2002/32/EC)**				
	o Feed containing undesirable substances exceeding the maximum level set (Annex I) may not be mixed for dilution purposes	x	x	x	o
	o Complementary feeding stuffs shall not contain levels of undesirable substances (Annex I) exceeding those for complete feed stuffs	x	x	x	x
	o Ban on use of animal protein as feed	x	x	x	x
	Directive on Preparation, placing on the market and use of medicated feedstuff (90/167/EEC)				
	o Medicated feeding stuffs shall be manufactured from authorized	o	x	x	x

code	legislation	FR	UK	AU	NZ
	medicated pre-mixes only				
	o Medicated feeds must be prescribed, prepared and distributed by a vet/authority	x	o	x	x
	o Keep daily records of production and distribution	x	x	x	o
	o Requirements on production	o	x	x	o
	o Requirements on packaging	o	x	x	o
	o Requirements on labelling	o	x	o	x
	o Max residue limits for veterinary drugs in foods	o	x	x	x
	o Regulation for procedures of manufacturing and supplying of pesticides and veterinary medicines	o	x	x	x
	o Procedures for use, registration and commercialisation of additives	o	x	x	x
	Regulation on Feed hygiene (183/2005)				
	o Feed should not be contaminated	x	x	x	x
	o Hygiene of production	x	x	x	x
	o Hygiene of packaging and distribution	x	x	x	x
	o Separate storage of hazardous materials	x	x	x	x
	o Keep records of measures put in place to control hazards	x	x	x	o
	o Source and use feed from registered establishments	x	x	x	o
	o Registration and approval system of feed businesses by national competent authorities	x	x	x	o
	Regulation on Additives for use in animal nutrition (1831/2003)				
	o Authorisation of a feed additive or its novel use	x	x	x	x
	o Registration of feed additives	x	x	o	x
	o Requirements on labelling and packaging	x	x	x	x
	Regulation on Placing on the market and use of feed (767/2009)				
	o Feed shall not contain or consist of materials whose placing on the market or use for animal nutrition is restricted or prohibited	x	x	x	x
	o Max level of feed additives in feed materials and complementary feed	x	x	x	x
	o Requirements on labelling, presentation and packaging	x	x	x	x
	o Requirements on placing on the market of specific types of feed	x	x	x	x
FS2	**Directive on Prevention of foot-and-mouth disease (2003/85/EC)**				
	o Bio-security: fences and truck baths	x	x	o	o
	o Screening tests, prevention and fighting schemes	x	x	x	x
	o Notify veterinary the (suspected) presence of the disease	x	x	x	x
	o Isolate animals, ban on movement, disinfection, destruction of carcasses	x	x	x	x
	o Measures to stop disease spreading, provide all necessary documents, sampling, slaughter animals, protected areas	x	x	x	x
	o Emergency vaccination	x	x	x	x
	Directive on Monitoring of zoonoses and zoonotic agents (2003/99/EC)				
	o Collect relevant and comparable data to identify and characterise hazards	x	x	x	x
	o Monitor farms and slaughterhouses	x	o	x	x

code	legislation	FR	UK	AU	NZ
	o Proper identification of samples	x	o	x	x
	o Regular tests	x	o	x	x
	o Keep records and report on results of analysis	x	o	o	x
	o Quarantine facilities	o	o	x	o
	o Protective clothes and shoes for visitors	o	o	o	x
	o Shower facilities for staff	o	o	o	x
	o Disposal of dead animals at a knackery	x	o	o	x
	o Vaccination (leptospirosis, brucellosis, tuberculosis)	o	o	o	x
FS4	**Regulation on Identification and registration of ovine and caprine animals (21/2004)**				
	o obligatory electronic identification	o	x	o	o
	o obligatory identification register	x	x	x	o
	o notify animal movement	x	x	x	o
	o animals identified by ear tag and management of (lost/illegible) tags	x	x	x	o

Symbols: x = enforced in the country; o = no specific legislation

A. ENVIRONMENT

The **Nitrate Directive** applies to France and the United Kingdom and covers all issues related to organic manure produced by livestock on a farm, its storage and distribution on the fields. In France the paragraph about "special equipment to avoid leakage" was not in the transposition of the Nitrate Directive, but in another French legislation (ICPE: classified installations for environmental protection). Only very few similar regulations can be found in New Zealand. Some of these regulations also exist in Australia (few of them are in force, only in some federal states), but they are totally irrelevant to sheep. This is because environmental conditions are such that sheep are run outdoors all year round. This legislation aims to protect Europe's waters by preventing nitrates from agricultural sources from polluting groundwater and surface waters and to encourage the use of good agricultural practices.

The Implementation of the Nitrate Directive in France and the UK takes place via the establishment of Nitrate Vulnerable Zones (NVZ). If land is located within a NVZ, the producer must comply with an NVZ Action Programme. This is composed of a number of measures.

- There is a general ban on the application of chemical fertiliser or manure during autumn and winter. Organic manures or N fertilisers cannot be applied where the ground is waterlogged, flooded, frozen hard or snow covered.
- There must be sufficient slurry storage facilities (or alternative arrangements) to cater to the period in which application is prohibited.

- Crop requirement limits must be respected by not applying more N than a crop requires. Soil N supply, excess winter rainfall and plant or crop available N from organic manures must all be taken into account.
- N fertiliser and organic manures should be spread as evenly and accurately as possible. Furthermore it cannot be applied to steeply sloping fields or in a way that contaminates watercourses (where organic manures cannot be applied within 10 m of watercourses).
- Any material or fertiliser that contains N and is applied to the land must be taken into account in the N fertiliser calculations. Producers must keep farm and field records on cropping, livestock numbers, N fertiliser usage and manure usage, for a minimum of five years after the relevant activity has taken place.
- The Nitrate Directive therefore limits the stocking rate to < 170 kg N per ha (for instance 15 ewes per ha each producing 1.2 lambs).

B. ANIMAL WELFARE

The **Directive on Protection of animals kept for farming purposes** does not foresee specific requirements for sheep.

C. FOOD SAFETY AND ANIMAL HEALTH

The group "**Food Safety 1**" applies to France and the United Kingdom and contains five directives and regulations which directly interest feed mills. Costs concerning the feed mill industry may translate into higher feed prices for the farm. There are regulations similar to the Directives on Undesirable substances in animal feed and Medicated feedstuffs in Australia.

The group "**Food Safety 2**" applies to France and the United Kingdom and contains two directives dealing with the prevention of diseases. There is a similar regulation called Australian Veterinary Emergency Plan (AUSVETPLAN) for Australia. In New Zealand some of these legislations also exist.

To prevent foot-and-mouth disease, special measures have to be taken to control the outbreak of this disease. The most important are listed below.

- The presence or the suspected presence of food-and-mouth disease has to be notified to the competent authority without delay and these animals have to be kept away from other animals.

- No animal may enter or leave the holding. A census has to be made and the number of animals dead or suspected of being infected or contaminated has to be recorded. All animal products on the holding have to be recorded and those records must be maintained.
- An epidemiological inquiry is carried out and if necessary, a preventive eradication programme is started. Buildings, their surroundings and vehicles shall be cleaned and disinfected.

To control zoonoses and zoonotic agents, monitoring has to take place.

- In case of zoonoses, samples have to be taken and analysed by a laboratory. Results must be stored for at least two years.
- Dead animals have to be disposed of through an authorised knackery.
- Exchange of information is sought. Yearly reports by the Member States have to be sent to the Commission. Therein the laboratory methodology used for the detection of resistance and identification of microbial isolation and the methods used for the data collection must be provided.

The group "**Food Safety 4**" applies to France and the United Kingdom and contains only one regulation. This regulation deals with the identification and registration of sheep. The corresponding regulation for Australia is the "National Animal Identification Scheme". The system for identification and registration shall comprise the following four elements:

- All animals born after 9th July 2005 shall be identified within 6 months, and in any case before the animal itself leaves the holding.
- Up-to-date registers are to be kept on each holding. The register may be kept manually or in computerised form, and is to be available at all times on the holding and to the competent authority, upon request, for a minimum period of at least three years.
- Transportation documents: transfer of sheep within the national territory between two separate holdings shall be accompanied by a transfer document. The keeper at the holding of destination shall keep the transfer document for at least three years.
- Each competent authority of each Member State is required to keep a central register of the holdings that keep animals in their territory. If a keeper keeps animals permanently, he/she shall make an inventory of the animals kept at regular intervals (at least annually).

4.3.5.2. *Cost items list and potential impact at farm level by country*

In the following table, the cost items generated by the implementation of the legislation at farm level are listed. The detailed list is based on the information collected via the experts and the panels carried out in each country in order to identify real additional costs faced by the farmers due to the legislation. The cross indicates in which country the cost item was identified as compliance cost.

Table 4.27 – Comparison of legislative areas impacting cost of compliance in sheep production

legislation		item	FR	UK	AU	NZ
ENV	Directive 2001/81/EC	non-burning of bale wraps				x
	Directive 2008/98/EC	recycling of agrichemical containers				x
	Directive 91/676/EEC	fertilisation planning	x			x
	Directive 91/676/EEC	applying training and certification for disposal of sheep dip		x		
	Directive 2009/128/EC	separate lockable vaccine fridge			x	
	Directive 2009/128/EC	chemical storage shed			x	
	Directive 2009/128/EC	training course for dangerous chemicals			x	
	GAEC 2	land availability for production and pest control				x
	GAEC 2	attending accreditation course				x
	Directive 92/43/EEC	damage caused by wild animals			x	
	Directive 92/43/EEC	predator species control				x
AW	Directive 98/58/EC	stock being off pasture 2 hours before transport				x
FS 1	Directive 90/167/EEC	keeping conventional Day Diary for veterinary medical records		x		
	Regulation 183/2005	record keeping system		x		
	Regulation 1831/2003	inspection of the farm and accreditation of livestock handling practices, facilities and maintenance of a log of all animal interventions				x
	Regulation 1831/2003	Animal Status Declaration at time of stock transfer off the farm				x
FS 2	Directive 2003/85/EC	periodic updating of farm database				x
	Directive 2003/99/EC	burying animals on farm		x		
	Directive 2003/99/EC	quarantine housing (6 day stand still period)		x		
FS 4	Regulation 21/2004	use of ear tags			x	

Symbols: x = identified as compliance cost

For the Third Country, the laws shown in the table are the European equivalent to these countries' specific Third Country legislations. The equivalent legislation for NZ for the directives 2001/81/EC (Waste Framework Directive) and 2008/98/EC (directive on national emission ceilings for certain

atmospheric pollutants) is the Atmospheric Pollutants legislation and for the GAEC 2, the Resource Management Act. For Australia the similar regulation corresponding to Directive 2009/128/EC is the Occupational Health and Safety Regulation 2001. The Directive 92/43/EEC is equivalent to the Wildlife Acts in the two countries.

Regarding the Animal welfare legislation, the Directive 98/58/EC is equivalent to the Animal Welfare Act and Code of Practice in NZ. Regarding Food Safety legislation, Regulation 21/2004 is equivalent to the National Livestock Identification Scheme 2004/46 in Australia.

4.3.6. Cost of compliance with selected legislation

This section analyses the cost of compliance with the legislations regarding the environment, animal welfare and food safety for the selected farms. The analysis does not detail the cost items used above for the comparative analysis of production costs, nor is revenue part of the objective at this point. Only the figures referring to total costs are shown.

As there are no specific requirements related to the "Directive on the Protection of animals kept for farming purposes" for sheep there are no costs of compliance related to animal welfare legislation.

Table 4.28 and Table 4.29, which respectively refer to the environment and food safety, the absolute values of the base scenario (with legislation) and the 'without' legislation scenario are shown for each typical farm, as well as the absolute difference and the percentage change with respect to the base situation. Figure 4.14 and Figure 4.15 depict the costs of compliance with environment legislation and food safety and animal health legislation in the selected countries.

Table 4.28 – Costs of compliance with environment legislation for sheep in selected countries

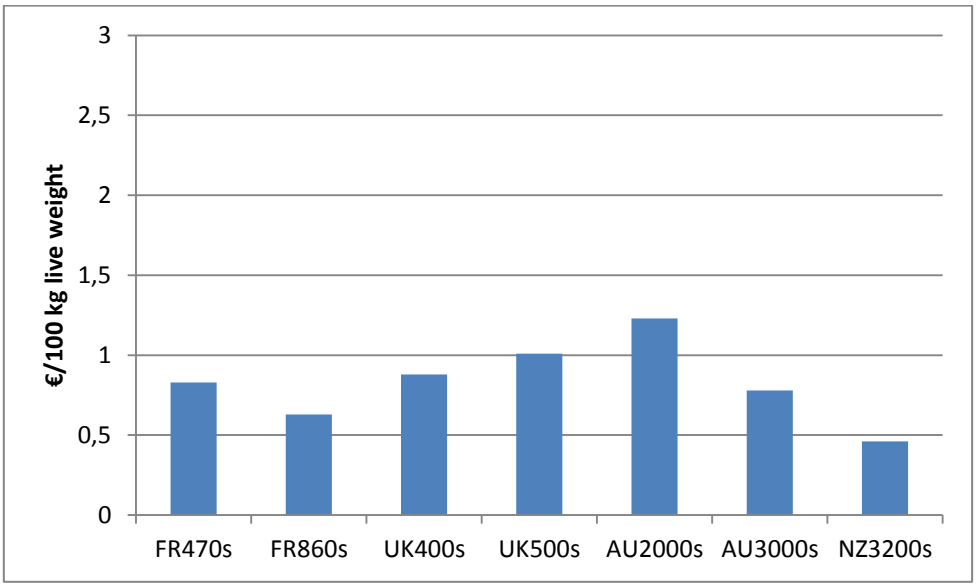
Environment		unit	base	without	difference	% change
France	FR470s	€/100 kg LW	351.15	350.32	0.83	0.24
	FR860s	€/100 kg LW	373.24	372.61	0.63	0.17
United Kingdom	UK400s	€/100 kg LW	358.15	357.28	0.88	0.24
	UK500s	€/100 kg LW	308.07	307.06	1.01	0.33
Australia	AU2000s	€/100 kg LW	139.95	138.72	1.23	0.88
	AU3000s	€/100 kg LW	185.20	184.42	0.78	0.42
New Zealand	NZ3200s	€/100 kg LW	85.97	85.51	0.46	0.53

Own calculation

In the EU Member States, the costs of compliance regarding the Nitrate Directive are comparable. The Nitrate Directive is irrelevant in most parts of Australia and New Zealand due to the

environmental conditions that allow sheep to be run out doors all year around in the countries. Fertilizer application is not extensive and in mixed farming areas where sheep and crops are run together, fertilizer application is generally made in the cropping phase at relatively low rates compared with European standards. In the Third Countries, Australia ranks first and is on the same level as the European farms.

Figure 4.14 – Cost of compliance with environment legislation for sheep in selected countries



Own calculation

As there are no specific requirements related to the "Directive on the Protection of animals kept for farming purposes" for sheep there are no costs of compliance related to animal welfare legislation.

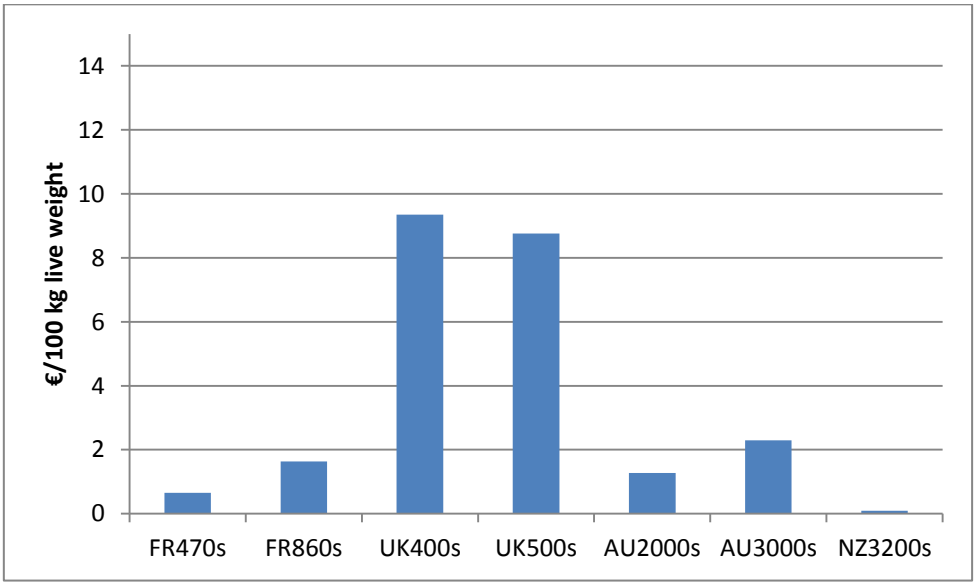
The cost of compliance for food safety regulations are highest for the United Kingdom, but the other European Member States are also affected by the regulations. In the United Kingdom legislation requires the use the electronic ear tags and a Day Diary for veterinarian medical records. Without these requirements, farmers would use conventional ear tags (which saves about 0.6 € per tag) and a medicine' book for medical records. The lowest cost effect can be found in France where the legislation requires the use two ear tags (one electronic and one conventional one). Without the legislation, the French farmers would react in different ways. Both possibilities are considered in the study. Farmers would normally use only one common ear tag instead of two (only one conventional ear tag in FR860s, which would save 0.9 € per tag and only one electronic ear tag in FR470s, which would save 0.2 € per tag). Among the Third Countries, Australian farms have higher costs due to the national legislation corresponding to the European food safety regulations. The typical farm in New Zealand is less affected by equivalent legislation.

Table 4.29 – Cost of compliance with food safety and animal health legislation for sheep in selected countries

food safety		unit	base	without	difference	% change
France	FR470s	€/100 kg LW	351.15	350.51	0.65	0.18
	FR860s	€/100 kg LW	373.24	371.61	1.63	0.44
United Kingdom	UK400s	€/100 kg LW	358.15	348.81	9.35	2.61
	UK500s	€/100 kg LW	308.07	299.31	8.76	2.84
Australia	AU2000s	€/100 kg LW	139.95	138.69	1.27	0.90
	AU3000s	€/100 kg LW	185.20	182.90	2.29	1.24
New Zealand	NZ3200s	€/100 kg LW	85.97	85.88	0.09	0.10

Own calculations

Figure 4.15 – Cost of compliance with food safety and animal health legislation for sheep in selected countries



Own calculations

The preceding tables and figures describe the impact of the three normative areas considered in their entirety. However they do not provide much information on the effect of a single piece of legislation on each specific country. This shortcoming is overcome through the table and the chart illustrated below, where the cost of compliance is separated into components. Note that the table gives the change of the "without legislation" scenario compared to the base situation.

For sheep typical farms in the EU, food safety legislation on average reveals relatively higher compliance costs when compared to other legislation fields. The highest impact can be observed in the UK (Table 4.30). Animal welfare is only relevant in the latter country, while the Nitrate Directive generally causes minimum effects, ranging from 0.17% to 0.33%. In Third Countries,

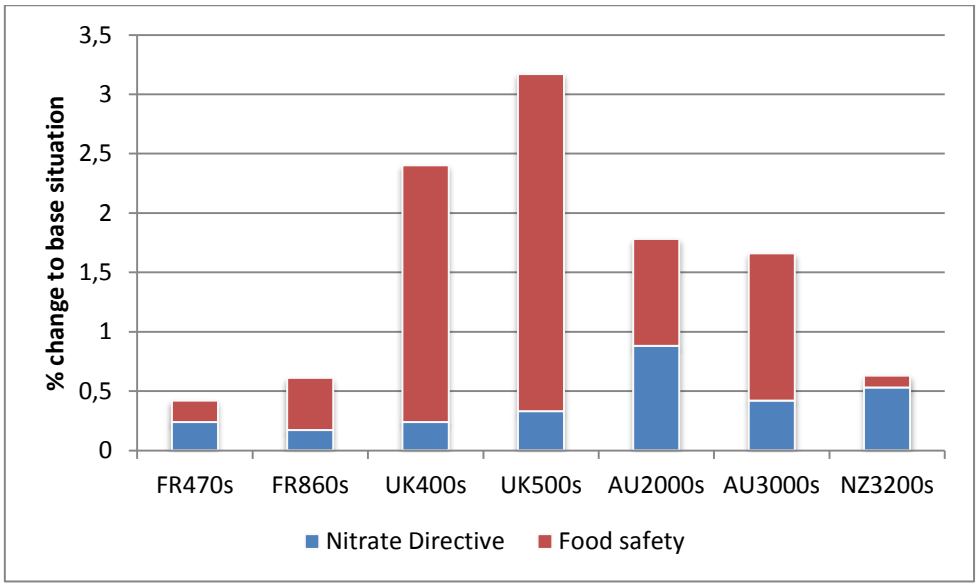
animal welfare is not a cost item, while the environmental legislation comparable to the Nitrate Directive causes significant effects.

Table 4.30 – Comparison of percentage change to base by normative area: sheep

	Nitrate Directive	Animal welfare	Food safety and animal health	TOTAL
FR470s	0.24	0.00	0.18	0.42
FR860s	0.17	0.00	0.44	0.60
UK400s	0.24	0.00	2.61	2.85
UK500s	0.33	0.00	2.84	3.17
AU2000s	0.88	0.00	0.90	1.78
AU3000s	0.42	0.00	1.24	1.66
NZ3200s	0.53	0.00	0.10	0.63

Own calculation

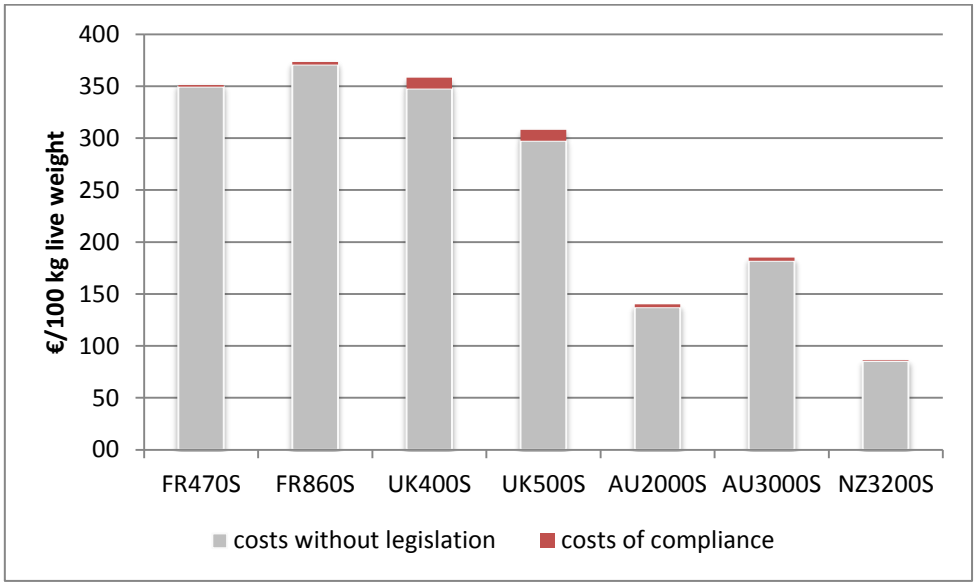
Figure 4.16 – Comparison of percentage change to base by normative area: sheep



Own calculation

The figure below compares the total cost with and without legislation for the typical sheep farms.

Figure 4.17 – Comparison of production and compliance costs for sheep meat



Own calculation

Cost of compliance for all farms is rather limited and does not exceed 3.5 percent in any of the farms analysed. Much like beef, the proportion of non-factor costs is the highest and represents between 50 and 60 percent of total costs. It is slightly lower than in beef production because sheep is more labour intensive.

There are many reasons for the low proportion of compliance costs. Some legislation, for example, regarding hygiene rules for food of animal origin were considered by the sheep farms since if they did not, the farms would have trouble selling their products under current market requirements. So the legislation intervened when most techniques applied were already common practice. Other legislations have less impact on costs as the adjustments to legislation occurred gradually. Thus the effect on the profitability of sheep production is limited in a given time period. Any costs arising from the adjustments are not necessarily considered as compliance costs in a specific year. They are regarded as general investments for farm development. Changes in legislation often coincide with technological changes and innovations.

The limited compliance costs differ in the different Member States. These differences are sometimes smaller between Member States and Third Countries than between Member States within the EU. The main reasons are differences in farm structure (see Tables 4.22 and 4.23), natural conditions and farming practices as well as the degree of adaptation to legislation. Therefore economies of scale can lead to a smaller cost effect on a per kg basis for a specific legislation in countries where the typical farms have a higher number of animals than in countries where smaller farms exist.. Furthermore the production cost drivers (like land and labour) for sheep meat vary

between the EU Member States. If one of these factors is also effected by legislation (e.g. if lost ear tags have to be replaced), the costs of compliance differ due to the different wages per hour a farmer needs to replace the ear tag.

The competitiveness of the EU sheep production is influenced negatively by a smaller herd size and high labour costs compared to the sheep farms in Australia and New Zealand. Compliance costs have a much lower impact of the degree of competitiveness of sheep meat production in the selected EU Member States.

4.4. Case study: Pork meat

4.4.1. Choice of countries

In order to represent all the different aspects of the pork sector, four Member States of the European Union with different pig production characteristics were chosen. Two Third Countries were selected as well for comparison purposes. The selection followed the criteria outlined in the methodological chapter. The resulting group of countries is composed of: Denmark, Germany, the Netherlands, Poland, Brazil and the United States of America. The four EU States represent 44% of the total EU-27 pig population, of which the major exporters are Denmark and the Netherlands. To represent the USA, the state of Iowa was chosen in light of its being the most important production area of the federation. In Brazil, the farms were set in the federative State of Santa Catarina.

4.4.2. National farm structure

The major attributes of the countries analysed are presented at a general level in the table below.

Table 4.31 – General information on pig producing countries. 2010

	unit	DK	DE	NL	PL	EU-27	BR	USA	World
Production	1,000 tons	1,666	5,443	1,288	1,741	22,769	3,078	10,186	109,215
Sows	1,000 heads	1,078	2,364	1,093	1,423	-	1,594	5,778	-
Pigs	1,000 heads	12,410	27,571	12,254	15,244	152,142	32,511	64,925	971,801
Total farms	units	5,070	60,100	7,030	388,460	-	38,910*	69,100	-
Currency		DKR	EUR	EUR	PLN	EUR	BRL	USD	-
GNI per capita[22]	$	41,540	38,410	41,010	19,220	-	10,980	47,220	-

[1] *Only farms with > 100 head pigs in 2006*

Source: Eurostat, Faosstat, DST, USDA, IBGE, Abipec

In the EU, Denmark and the Netherlands rather large pig farms are common, with over 90% of animals raised on farms with more than 1,000 animals. Germany still raises a significant share

[22] Gross National Income (GNI) per capita is based on purchasing power parity (PPP). The indicator is calculated converting gross national income to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad

(25%) of its pigs on farms with 400 to 999 pigs, however a major portion (64%) are raised on large farms. In Poland, which represents the most important pork producer of Eastern Europe, farm size differs completely: almost 40% of the pigs are raised on small to very small farms, whereas only 25% are fattened on larger farms. As for the Third Countries, in the United States large to very large farms predominate both at a national level and in Iowa. Therefore, although almost 50,000 farms in the US still fall in the category with up to 200 pigs, their share in the total number of pigs is below 1%. For Brazil, the typical farms were set in the federative State of Santa Catarina, where medium-sized pig farms predominate. The two farms represent different stages of production.

4.4.3. Typical farm structure

The analyses of compliance costs for the selected pig producing countries were conducted according to the theoretical framework and the defined methodological approach. Note that the analysis relies on a typical farm approach, which stems from a number of the theoretical assumptions discussed previously. They are non-existent farms. A brief description of the typical pig farms included in the analysis of the cost of compliance, together with their most relevant characteristics, is provided hereafter.

Significant differences are detectable between the countries analysed in terms of pig farm size and levels of productivity which will now be discussed in more detail.

Denmark is characterized by big sow herds with very high levels of productivity, allowing for the production of low priced piglets which are mainly exported to other EU Member States. This high productivity is explained by the experience acquired over time, in the improvement of genetics and high farm management standards. Production results are at top levels both for the sow herd and on the fattening farms. The live weight at slaughter for Danish pigs is quite low as an important export market is the UK, which demands light cuts of pork.

The Netherlands follow Denmark in productivity and have slightly smaller pig farms. However positions are reversed when the pigs sold per sow are considered (26.52 in the Netherlands vs 26.24 in Denmark). The country is renowned for its piglet and pork export as well as its strong competitiveness on the EU market, mainly due to good on-farm technical achievements.

German pig farms are, on the other hand, smaller family-owned farms with more modest levels of productivity. An important consequence is that the country is increasingly importing piglets from abroad, especially from Denmark (circa 60%) and the Netherlands (circa 40%). Pigs are slaughtered at a higher weight than other EU Member States due to the requirements of the processing industry.

In Poland, the pig farms are predominantly small, family-owned businesses. Although a few large holdings are in operation, the typical Polish farm raises about 50 sows and fattens their pigs on the same site. The technical consequence of this structural condition is that the pig farms lag behind other EU Member States in terms of technical efficiency and labour productivity. As may have been expected, pig farms in the US are huge. The typical pig farm in Iowa, reference State for this study, raises 3,200 sows and fattens around 90,000 pigs on 12 units, each with up to 2,999 pigs per barn. This fattening farm is at the upper size limit due to US environmental legislation, which imposes obligations on farms above this size. When compared with European pig farms, the productivity levels of the US sow herd do not reach the levels of Denmark or the Netherlands. It is, nonetheless, highly productive.

Two typical farms in Brazil were selected for this study- both in the State of Santa Catarina which is the most important pig producing state in the federation, located in the South of the country. From a general standpoint, the main characteristics of the enterprises is the use of a segregated system, with a production split between piglet producers and finishers, medium-sized herds and contracted family farms. These features distinguish them from the producers in the central-western areas of Brazil where huge pig farms dominate the scene, often with high productivity levels.

A brief description of the typical pig farms included in the analysis of the cost of compliance, together with their most relevant characteristics, is provided hereafter.

Table 4.32 illustrates a selection of key variables that serve the purpose of describing the pig herd in the selected countries, as well as their production systems.

DK614 represents a pig farm with 614 sows and 1,462 fatteners. This pig farm produces 1,286 kg of lean meat per sow. The average live weight at slaughter is 107 kg. The Danish sow herds are the most productive in the EU with 28 piglets weaned per sow per year. This high productivity can be ascribed to the high number of litters per sow (2.26) and the high number of piglets born alive per litter (14.50).

DE187 represents a smaller pig farm with 187 sows and 1,000 fattening pigs. The lean meat production of this typical German pig farm is 1,238 kg per sow. The average live weight at slaughter is 120 kg. The productivity of the sow herd of this typical farm is of 24, 8 piglets weaned per sow. With an average daily gain of 754 g per day, the performance of the fattening activity is rather modest in comparison to the pig farms of the other countries analysed in this study.

NL369: The compliance cost calculations of the typical Dutch farm refer to the average size of a sow farm in the Netherlands which, according to the Interpig database of 2010, raises 369 sows. This average sow farm sells 9,786 pigs per year (369*26.52). In order to fatten all these pigs, a fattening farm with 3,250 places is needed (3,01 pigs per place per year). This farm (369 sows and 3,250 fattening pigs) produces 891.504 kg of pork (cold weight). The various calculations are based on this number of sows and fattening pigs producing 891.504 kg of pork.

PL50 is a typical, small, family farm with 50 sows and 1,070 fatteners. The productivity of this closed cycle pig farm is lower than on the other typical farms in the EU in this study as it averaged 22.07 piglets per sow in 2010. The number of pigs born per litter is particularly low (10.51) and the limited number of litters per sow reduces the overall sow productivity. These data are typical of Polish pig farm.

BR500 and **BR750** are two typical farms located in the State of Santa Catarina, which represent a piglet producing farm with 500 sows and a fattening farm with 750 pig places. The average lean meat production of Santa Catarina is 1,175 kg/sow. The average live weight at slaughter is 118 kg.

The productivity of the sow herd is of 24.16 weaned piglets per sow per year. In the analysis they are treated as a closed cycle farm.

USA3200 is represented by a typical number of 3,200 sows that produce 90,000 fattening pigs each year. Animals are fed in twelve, 2,999 capacity finishing barns, with 2.4 to 2.5 fattening cycles per year.

Table 4.32 – Typical pig farms: key variables of the swine herd

	DK614	DE187	NL369	PL50	BR500	BR750	USA3200
Farm size (units of sows)	614	187	369	50	500		3,200
Farm size (units of fattening pigs[1])	1,462	1,000	1,422	350		750	2,999
Animals' origin	Own animals	Own animals	Own animals	Own animals	Own animals	Different producers	Own animals
Pigs sold/year	6,514	2,880	4,280	1,070	11,840	2,179	7,497
Legal form	BF	FF	FF	FF	FF	FF	BF
Average days in rearing unit (days)	54	51	50	49	34		39
Rearing daily live weight gain (g/day)	450	440	365	407	440		434
Rearing feed-conversion ratio	1.73	1.68	1.55	1.75	1.60		1.61
Empty rearing unit days per cycle	5	5	5	5	5		5
Pigs per pig place per year (rearing)	6.23	6.53	6.65	6.71	9.3		8.26
Average days in finishing unit (days)	85	120	114	107		116	124
Average daily gain in finishing (g/day)	895	754	799	847		820	802
Finishing feed-conversion ratio	2.68	2.87	2.63	2.94		2.60	2.94
Empty finishing unit days per cycle	7	7	7	7		7	9
Pigs per pig place per year (finishing)	3.95	2.88	3.01	3.21		2.97	2.74
Average live weight at slaughter (kg)	107.8	120.3	116.4	117		118	122.5
Average lean meat (%)	60.2	56.7	56.5	56.7		58	57
Total land (ha)	210[2]	60	5	30	66	37	39
Share of arable land (%)					40	37	434
Share of pasture land (%)					24	27	1.61
Irrigation (%)					0	0	5

[1] *pig places/average pigs on farm*

[2] *based on average farmland owned or rented and compared to animal unit in the Interpig database; not including land for buildings*

FF: family farm; BF Agribusiness farm

4.4.4. Costs of production

The aim of the table and figure presented here is to offer an overview of the total cost of production as well as the cost structure in the different countries analysed. The cost categories defined for the analysis (land cost, labour cost, capital cost and non-factor costs) are shown as stacked bars, whose summed height represents the total cost level. Pig prices are presented as a line.

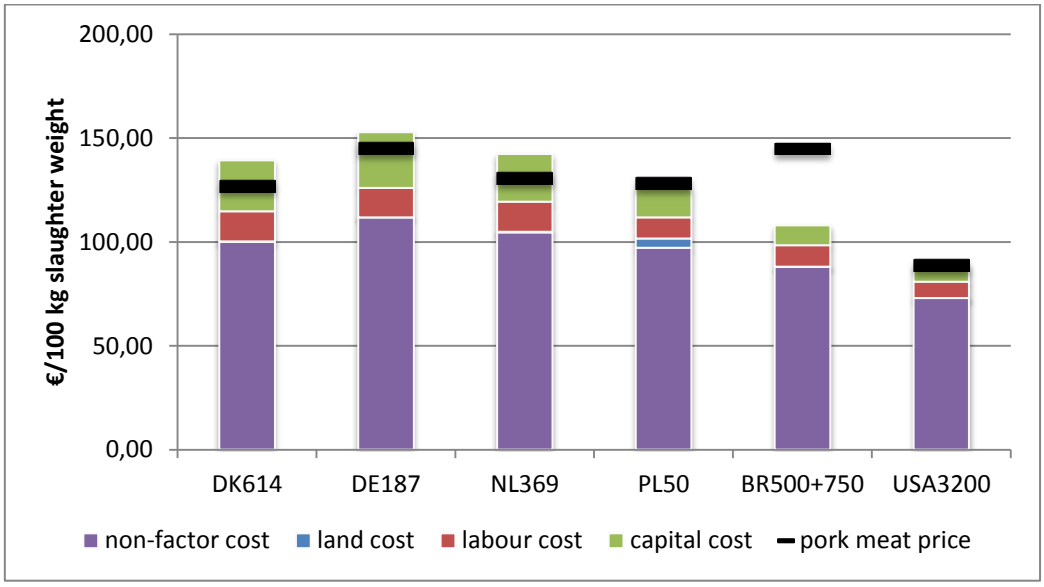
Note that the aim of this section is to compare the typical farms on the basis of the *base scenario*, therefore showing only the figures referred to the "with" legislation situation. The comparative analysis of production costs results from the chart and the table provide below. The latter gives the absolute values, broken down according to the defined cost categories (land, labour, capital, non-factor costs), and reveals the specific differences for each across the countries. The graphic representation adds clarity to the analysis, visualising the peculiarities of each typical farm.

Table 4.33 – Pork meat production costs in selected countries, 2010

	unit	DK614	DE187	NL369	PL50	BR500+750	USA3200
land cost	€/100 kg SW	0.11	0.01	0.36	4.55	0.02	0.06
labour cost	€/100 kg SW	14.56	14.12	14.50	10.12	10.41	7.77
capital cost	€/100 kg SW	24.44	26.86	22.89	13.86	9.47	8.09
non-factor cost	€/100 kg SW	100.05	111.78	104.55	97.13	88.02	72.96
total cost	€/100 kg SW	139.16	152.76	142.3	125.66	107.92	88.88
pork price	€/100 kg SW	126.80	145.00	130.46	127.99	144.63	88.57

Sources: EMBRAPA swine and poultry (Brazil); Own calculation

Figure 4.18 – Pork meat production costs in selected countries, 2010



Own calculation

Within the EU, Poland has rather low production costs, mainly owing to the low cost of labour and capital. Production costs in Brazil and the USA are low because of low feed and capital costs. The pig farms in the US are able to exploit significant economies of scale because of their larger size, whereas in Brazil capital costs are low, as the climatic conditions allows for cheaper animal housing conditions for pig farmers. Another important explanation for the lower production costs in Brazil is that labour costs per hour are about 70% lower than in the EU. Among the EU Member States, the production costs are slightly lower in Denmark than in Germany and in the Netherlands because of the high technical productivity of the pig herd on Danish farms.

The revenue differences between the countries are also relevant: revenues are very low in the US, while in Germany prices are high. These differences exert an influence on the profitability of pig production in the countries studied. Outcomes are positive in Poland and Brazil, due to labour costs in particular, whereas in Germany, the Netherlands, Denmark and the US revenues were not able to fully cover the production costs in 2010. However, note that Brazilian pig market conditions are very volatile, and the high profitability recorded in 2010 does not represent the average profitability of the last years, which was, on the contrary, often negative.

The different level of production costs noticed in the previous figure can be ascribed to a number of parameters (Table 4.34) which, together with those listed in section 1.3 "typical farm structure", constitute the major drivers.

Table 4.34 – Production cost drivers: pork meat

cost item	Denmark	Germany	Netherlands	Poland	Brazil	USA
Labour (€/h)	21.90	15.70	30.00	5.00	3.86	15.79
Average compound feed price for finishing pigs (€/ton)	201.08	199.60	223.50	200.00	201.71	172.10
Maize price (€/ton)	159.50*	195.33	197.32	195.00	127.88	160.00
Finishing feed conversion ratio	2.68	2.87	2.63	2.94	2.60	2.94

** based on price of wheat (147.7 €/ton wheat) and multiplied by 1.08 (MJ maize/kg/MJ wheat/kg)*

Source: InterPIG 2010, Landwirtschaftskammer Niedersachsen 2010, Landwirtschaftskammer Nordrhein-Westfalen 2010

4.4.5. Selected legislation

The influence of the specific set of directives and regulations selected for the pig case study on the economics of pork meat production has been assessed. The 14 directives and regulations were chosen and clustered into the groups of the environment, animal welfare and food safety. Specifically, "the environment" (ENV) refers to the Nitrate Directive and the Integrated Pollution Prevention and Control (IPPC) Directive, while "animal welfare" refers to the Directive

2008/120/EC on the protection of pigs. "Food safety" (FS) is sub-clustered into three groups which cover aspects connected to feed mills and the production of animal feed, the prevention and control of diseases, and the prohibition of hormonal substances.

The analysis is shown in a table, in which the farmers' actions are listed as required by each law as well as in which country these have to be applied.

4.4.5.1. Legislation requirements

An initial level of comparison contrasts the directives selected for each of the areas investigated (the environment, animal welfare and food safety) with their specific requirements. The inquiry distinguishes whether the latter are applicable to each of the countries chosen, as well as if and how they have been implemented into the national set of norms. The aim of the table is to offer an immediate insight in the binding legislative conditions affecting pig farming. In this light, the two Third Countries are included in the comparison together with the EU Member States in order to cover the equivalent environmental, animal welfare and food safety areas without an explicit reference to their peculiar body of laws.

The knowledge resulting from the analysis of legislative requirements sets the foundation for the subsequent analysis of the cost of compliance.

Table 4.35 – Specific normative requirements of selected legislation for pig production

code	legislation	DK	DE	NL	PL	BR	USA
ENV	**Nitrate Directive (91/676/EEC)**						
	o Nitrate Vulnerable Zones	x	x	x	x	o	o
	o establish fertilizer planning	x	o	o	x	o	o
	o max level of fertilizer for each crop	x	x	o	o	o	o
	o ban on use of chemical fertiliser/manure in autumn/winter	x	x	x	x	o	o
	o max level of N from manure (kg/ha/year)	170	170	170	170	o	o
	o special storage vessels for manure	x	x	o	x	o	o
	o special spreading conditions (i.e. max distance to water body)	x	x	x	x	x	o
	IPPC Directive (2008/1/EC)						
	o environmental integrated permit	x	o	o	x	o	o
	o use of BATs	x	x	x	x	o	o
	o ammonia emission limits	x	x	x	o	o	o
	o requirements on animal housing	o	o	x	o	o	o
AW	**Directive on Protection of pigs (2008/120/EC)**						
	o minimum unobstructed floor area for sows	x	x	x	x	o	o
	o minimum space for gilts and sows	x	x	x	x	o	o
	o minimum length of sides of pen for sows	x	x	x	x	o	o
	o minimum unobstructed floor area for boars	x	x	x	x	o	o

code	legislation	DK	DE	NL	PL	BR	USA
	o minimum space for boars	x	x	x	x	o	o
	o ban on tethers for sows and gilts	x	x	x	x	o	o
	o ban on individual stalls for pregnant sows	x	x	x	x	o	o
	o rules for quality of flooring surfaces	x	x	x	x	o	o
	o access to manipulable material	x	x	x	x	o	o
	o feeding at least once a day	x	x	x	x	o	o
	o feeding system in grouped housed sows	x	x	x	x	o	o
	o sufficient quantity of high-fibre food for sows and gilts	x	x	x	x	o	o
	o restrain mixing of weaning and rearing pigs	x	o	x	x	o	o
	o measures to prevent fighting among pigs	x	o	x	x	o	o
	o availability of individual pens	x	x	o	x	o	o
	o maximum noise levels	x	x	o	x	o	o
	o light requirements	x	x	x	x	o	o
	o access to fresh water	x	x	x	x	o	o
	o limitations on tail docking and reduction of corner teeth	x	o	o	x	o	o
	o minimum weaning age	x	x	x	x	o	o
	o training courses for personnel	x	x	o	x	x	o
FS1	**Directive on Undesirable substances in animal feed (2002/32/EC)**						
	o feed containing undesirable substances exceeding the maximum level (Annex I) may not be mixed for dilution purposes	x	x	x	x	x	o
	o complementary feeding stuffs may not contain levels of undesirable substances (Annex I) exceeding those for complete feed stuffs	x	x	x	x	x	o
	o ban on the use of animal protein as feed for ruminants	o	o	o	o	x	o
	o requirements for forage crop production	o	o	o	o	o	o
	o requirements hay production (sampling of feed)	o	o	o	o	o	o
	o requirements of manufacturing of citrus pulp bran	o	o	o	o	x	o
	Directive on Preparation, placing on the market and use of medicated feedstuff (90/167/EEC)						
	o medicated feeding stuffs may be manufactured from authorized medicated pre-mixes only	x	x	x	o	x	x
	o medicated feeds must be prescribed, prepared and distributed by a vet/authority	x	o	x	x	x	x
	o keep daily records of production and distribution	x	o	o	o	x	o
	o requirements on production	x	o	o	o	x	o
	o requirements on packaging	x	o	o	o	x	o
	o requirements on labelling	x	o	x	o	x	o
	o max residue limits for veterinary drugs in foods	x	o	o	o	x	o
	o regulation for procedures of manufacturing and supplying of pesticides and veterinary medicines	x	o	o	o	x	o
	o procedures for use, registration and commercialisation of additives	x	o	x	x	x	x
	Regulation on Feed hygiene (183/2005)						
	o hygiene of production	x	x	x	x	x	o
	o hygiene of packaging and distribution	x	x	x	x	x	o
	o separate storage of hazardous materials	x	x	x	x	x	o
	o keep records of measures put in place to control hazards	x	x	x	x	x	o

code	legislation	DK	DE	NL	PL	BR	USA
	o source and use feed from registered establishments	x	x	x	x	x	o
	o register or be approved by the competent authority	x	x	x	x	x	o
	Regulation on Additives for use in animal nutrition (1831/2003)						
	o authorisation of a new feed additive or its novel use	x	x	x	x	x	o
	o registration of feed additives	x	x	x	o	x	o
	o requirements on labelling and packaging	x	x	x	o	x	o
	Regulation on Placing on the market and use of feed (767/2009)						
	o safety and marketing requirements	x	x	x	x	x	o
	Regulation on Animal by-products not intended for human consumption (1774/2002)						
	o ban on meat and bone meal	x	x	x	x	o	o
FS2	**Directive on Control of foot-and-mouth disease (2001/89/EC)**						
	o notify veterinary the (suspected) presence of the disease	x	x	x	x	x	o
	o isolate animals, ban on movement, disinfection, destruction of carcasses	x	x	x	x	x	o
	o measures to stop disease spreading, provide all necessary documents, sampling, slaughter animals, protected areas	x	x	x	x	x	o
	o all susceptible animals shall be killed in case of outbreak	x	x	x	x	x	o
	o emergency vaccination	o	o	x	x	x	o
	Directive on Control of classical swine fever (2003/85/EC)						
	o notify veterinary the (suspected) presence of the fever	x	x	x	x	x	o
	o isolate animals and ban on movement	x	x	o	o	x	o
	o measures to stop disease spreading, provide all necessary documents, sampling, slaughter animals, protected areas	x	x	x	x	x	o
	o all susceptible animals shall be killed in case of outbreak	x	x	x	x	x	o
	o emergency vaccination	x	x	x	o	x	o
	Directive on Control of swine vesicular disease (92/119/EEC)						
	o notify veterinary the (suspected) presence of the disease	x	x	x	x	x	o
	o isolate animals and ban on movement	x	x	x	x	x	o
	o measures to stop disease spreading, provide all necessary documents, sampling, slaughter animals, protected areas	x	x	x	x	x	o
	o all susceptible animals shall be killed in case of outbreak	x	x	x	x	x	o
	o emergency vaccination	o	o	x	x	x	o
	Directive on zoonotic agents (2003/99/EC)						
	o keep records and report on results of analysis	x	x	o	x	x	o
	o proper identification of samples	x	o	o	o	x	o
	o monitor of farms and slaughterhouses	x	x	x	x	x	x
FS3	**Directive on prohibition of hormonal substances (96/22/EC)**						
	o ban on feeding animals with substance with anabolic effect	x	x	o	x	x	x
	o ban on keeping substances with anabolic effect	x	o	o	o	o	o
	o ban on marketing treated animals or products derived therefrom	x	o	x	x	x	o

Symbols: x = enforced in the country; o = no specific legislation

A. ENVIRONMENT

The cost impact of the **Nitrate Directive** action programme is analysed in all the EU Member States (Denmark, Germany, the Netherlands and Poland) for the pork sector. The aim of the Directive is to protect ground and surface water from pollution caused by nitrates deriving from agricultural sources as well as to encourage the adoption of good farming practices. In Brazil, legislation at the State level pursues goals similar to those of the Nitrate Directive and sets a number of requirements. Manure spreading conditions are specified. A 120-day capacity storage system is required. The limit of 50 m^3 of pig manure per ha per year has been set and environmental licensing has been established. In the USA, the Clean Water Act is a piece of environmental legislation that especially impacts large pig farms.

The implementation of the Nitrate Directive in the EU is based on the establishment of Nitrate Vulnerable Zones (NVZs), in which the pig farmer is subject to a NVZ Action Programme that includes a number of measures.

- There is a general ban on the application of chemical fertilisers or manure during autumn and winter. Organic manure or N fertilisers cannot be applied where the ground is waterlogged, flooded, frozen hard or covered with snow.
- Slurry storage facilities with sufficient capacity must be available to cover the period during which application is prohibited. Otherwise alternative arrangements should be made.
- Crop requirement limits must be respected by not applying more N than a crop requires, taking into account elements like crop uptake, soil N supply, excess winter rainfall, and plant or crop- available N from organic manures.
- N fertilisers and organic manure should be spread as evenly and accurately as possible. Furthermore, they cannot be applied to steeply sloping fields or in a way that contaminates watercourses. Organic manures cannot be applied within 10 m of watercourses.
- Any material or fertiliser that contains N is applied to the land must be considered in the N fertiliser calculations. Producers must keep farm and field records on cropping, livestock numbers, N fertiliser usage and manure usage, for a minimum of five years after the relevant activity has taken place.
- The Nitrate Directive, lastly, limits the amount of manure to 170 kg N/ha per year.

The **IPPC Directive** is aimed at minimising the emissions of pollutants to air, water and land through the use of the best available techniques. The Directive applies to pig farms located in the

EU Member States that have at least 2,000 places for production pigs (over 30 kg), or at least 750 places for sows. No equivalent legislation exists in Brazil or the USA. The compliance costs related to this Directive include costs for the technologies (Best Available Techniques) listed in the Best Available Techniques Reference Document (BREFs) for pig farms.[23].

B. ANIMAL WELFARE

The **Directive on the Protection of pigs** imposes that farmers guarantee animals have enough space for movement, distinguishing the minimum surface for gilts, sows and fattening pigs. Stables should also be structured in compliance with the requirements regarding noise levels, ventilation, and light. Farmers should also be aware of the rules regarding the quality of flooring surfaces. Moreover, the Directive bans the use of tethers for sows and gilts, which have to be housed in groups during a period starting from four weeks after service to one week before farrowing. The Directive sets further limitations on the practices of tail docking and the reduction of corner teeth. Finally, individual pens should be available, though their use is prohibited for pregnant sows.

C. FOOD SAFETY AND ANIMAL HEALTH

There are three groups of food safety and animal health laws considered in the pig case study. The group "**Food Safety 1**" applies to Denmark, Germany, and Poland, and includes five directives and regulations which directly affect feed mills. Since compliance costs concerning the feed mill industry result in higher feed prices for the farm. The costs related to compliance with the group FS1 are not relevant for the Dutch pig farm. Note that some aspects of the Directives on Undesirable substances in animal feed and on Medicated feedstuffs are also relevant for Brazil, while in the USA, only the latter is covered by federal legislation.

The group "**Food Safety 2**" applies to Denmark, Germany the Netherlands and Poland, and includes four directives dealing with the prevention of diseases: classical swine fever, foot-and-mouth disease, swine vesicular disease, and zoonoses. The costs related to these norms refer to the prevention of the diseases and not to the cost inherent to an outbreak of a disease. Typical compliance costs are therefore generated by obligatory vaccinations, the analysis of samples, administration and veterinary activities. In both Brazil and the USA, similar legislation is in force

[23] It should be noted that in Denmark and in the Netherlands national legislation imposes the use of ammonia filters on pig farms that have to comply with the IPPC Directive. Investments in this equipment raises the cost of compliance in these two countries.

addressing the issue of zoonoses, and in the former, comparable measures targeting foot-and-mouth disease are also present.

The group "**Food Safety 3**" regards the prohibition of hormonal substances and the use of beta-antagonists. This case concerns the EU's ban on the use of ractopamine, a growth promoter, which is allowed in the USA.

D. NEW MEMBER STATE: POLAND

Given its status as a new Member State after joining the Union in 2004, Poland has adopted and implemented EU directives and regulations. The timetable followed is detailed below.

Table 4.36 – Timetable of the implementation of selected EU directives in Poland

Stage	Area	Legislation	Requirement
from January 2004	Environment	Directive 91/676/EEC on the protection of water against pollution caused by nitrates from agricultural sources	SMR 4
from January 2009	Environment	Directive 91/676/EEC on the protection of water against pollution caused by nitrates from agricultural sources	SMR 4
	Animal identification and registration	Regulation (EC) 1760/2000 establishing a system for the identification and registration of bovine animals (labelling of beef and beef products), amending Regulation (EC) 820/97	SMR 6-8
from January 2011	Public health Animal health Reporting of diseases Plant health	Regulation (EC) 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority, and laying down procedures in matter of food safety	SMR 11

4.4.5.2. Cost items list and potential impact at farm level by country

In the following table, the cost items generated by the implementation of the legislation at farm level are listed. The list is based on the information collected via the experts and the panels carried out in each country in order to identify real additional costs faced by the farmers due to the legislation. The cross indicates in which country the cost item was identified as compliance cost.

Note that the base scenario for Poland in 2010 does not include calculations concerning the obligations imposed by the Directive on Protection of pigs, since it barely implemented. Therefore, for the purposes of this study it is assumed that PL50 does not yet comply with said directive and only after 2010 will Polish farms need to adhere to these standards.

Note as well that DK shows no compliance costs associated with the directives about diseases prevention, since farmers would voluntarily implement protection measures if legislation was not enforced.

Table 4.37 - Comparison of legislative areas impacting compliance costs in pig production

legislation		item	DK	DE	NL	PL	BR	USA
ENV	Directive 91/676/EEC	minimum storage capacity	x	x	x	x	x	
		limit of 170 kg N/ha/year	x	x	x			
		manure transport	x	x	x			
		additional fertiliser	x	x	x		x	
	Directive 2008/1/EC	storage covering	x	x				
	Specific Third Countries	environmental licensing					x	
		limit of 50 m^3 manure/ha/year					x	
		Clean Water Act						x
AW	Directive 2008/120/EC	group housing	x	x	x			
		slatted floor	x	x	x			
		high fibre diet	x	x	x	x		
		manipulable material	x	x	x	x		
FS 1	Directive 2002/32/EC	feed production	x	x		x	x	
FS 2	Food safety 2	diseases prevention		x	x	x		

Symbols: x = identified as compliance cost

4.4.6. Costs of compliance with selected legislation

The aim of the section is to analyse the costs of compliance with the legislations clustered as "the environment", "animal welfare" and "food safety" for the typical farms studied. Here only figures of total costs are shown.

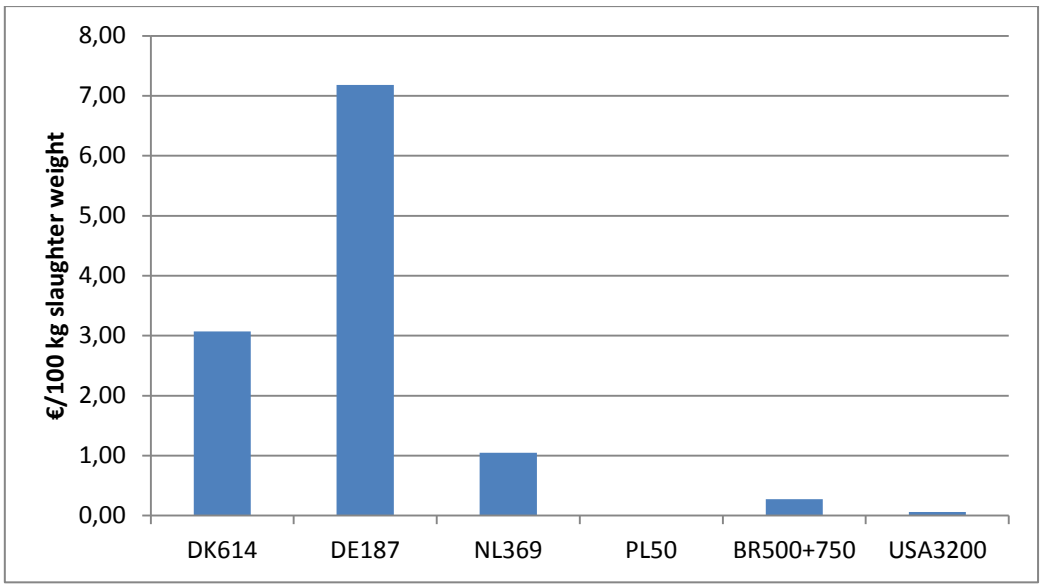
In Table 4.38, Table 4.39 and Table 4.40, which respectively refer to the environment, animal welfare and food safety, entries show the absolute values of the base scenario in 2010 ('with legislation') for each typical farm and the 'without legislation' scenario, as well as the absolute difference and the percentage change with respect to the base situation. The charts in Figure 4.19, Figure 4.20 and Figure 4.21 build upon the former value, visualising the total compliance costs that typical farmers face due to environmental, animal welfare and food safety legislation, respectively.

Table 4.38 – Costs of compliance with environment legislation for pigs in selected countries

environment		unit	base	without	difference	% change
Denmark	DK614	€/100 kg SW	139.16	136.09	3.07	2.21
Germany	DE187	€/100 kg SW	152.76	145.58	7.18	4.69
Netherlands	NL369	€/100 kg SW	142.30	141.25	1.05	0.74
Poland	PL50	€/100 kg SW	125.66	125.66	0.00	0.00
Brazil	BR500+750	€/100 kg SW	107.92	107.64	0.28	0.26
USA	USA3200	€/100 kg SW	88.88	88.82	0.06	0.07

Own calculation

Figure 4.19 – Costs of compliance with environmental legislation for pig farms in selected countries



Own calculation

In the table referring to the costs of compliance with environmental legislation, we can determine the countries where the latter cause an increase in production costs. In Denmark a cost increase of 2.21% has been calculated. The majority of the cost increase is due to compliance with IPPC Directive (1.63%)[24]. In Germany, the cost impact derives primarily from the Nitrate Directive (0.58%) and in minor part from the IPPC Directive, as only the covering of the manure storage has been considered. In the Netherlands the cost impact is also due predominantly to compliance with

[24] The national Danish interpretation of the IPPC Directive generates farmers' costs related to add-on techniques in the stable such as cooling slurry in canals, acidification of slurry, air cleaning with acid and biological air cleaning. In the absence of these national obligations the compliance costs of the Danish farms would be reduced by 1.97 €/100 kg

the Nitrate Directive, as pig farmers have to transport their excess manure to other farms[25]. Besides, manure storage facilities must be covered. However, since the storage is located underneath the barn on almost every farm, no additional costs were entailed. Polish typical pig farmers are not affected by either of these environmental laws. The designated Nitrate Vulnerable Zones include only 2% of the utilized agricultural area of the country. Note that, conversely to the case of dairy, pig farmers in Poland did not sustain the investments required to comply with the standards set by the Nitrate Directive before its implementation. Thus, because only 2% of the Polish territory is classified as nitrate vulnerable, and because such farms are not located within the NVZ, the Nitrate Directive did not cause any cost of compliance to pork producers in 2010. On the other hand, the size of the pig farms is rather small, and they are not subject to the requirements of the IPPC Directive. In Brazil the environmental costs for pig farmers are related to environmental licenses and minimum manure storage capacity, while the limit on spreading only up to 50 m^3 of pig manure/ha/year results in a cost reduction, since excess manure is usually collected by neighbours. In the USA, the Clean Water Act only affects the large pig farms, to a limited extent. The impact of this Act was substantial when it was first implemented; however the necessary investments had already been made by 2010.

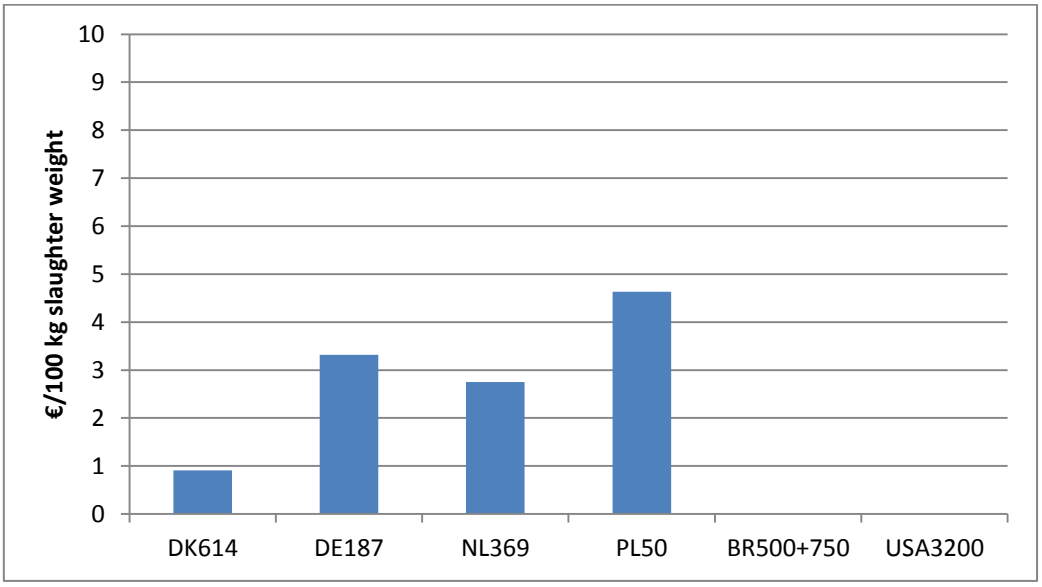
Table 4.39 – Cost of compliance with animal welfare legislation for pigs in selected countries

animal welfare		unit	base	without	difference	% change
Denmark	DK614	€/100 kg SW	139.16	138.25	0.91	0.65
Germany	DE187	€/100 kg SW	152.76	149.44	3.32	2.17
Netherlands	NL369	€/100 kg SW	142.30	139.55	2.75	1.93
Poland	PL50	€/100 kg SW	130.29	125.66	4.63	3.55
Brazil	BR500+750	€/100 kg SW	107.92	107.92	0.00	0.00
USA	USA3200	€/100 kg SW	88.88	88.88	0.00	0.00

Own calculation

[25] The national Dutch interpretation of the IPPC Directive generates farmers' costs related to investments in ammonia filtering technology. In the absence of these national obligations the compliance costs of the Dutch pig farms would be reduced by 2.31 €/100 kg.

Figure 4.20 – Cost of compliance with animal welfare legislation for pigs in selected countries



Own calculation

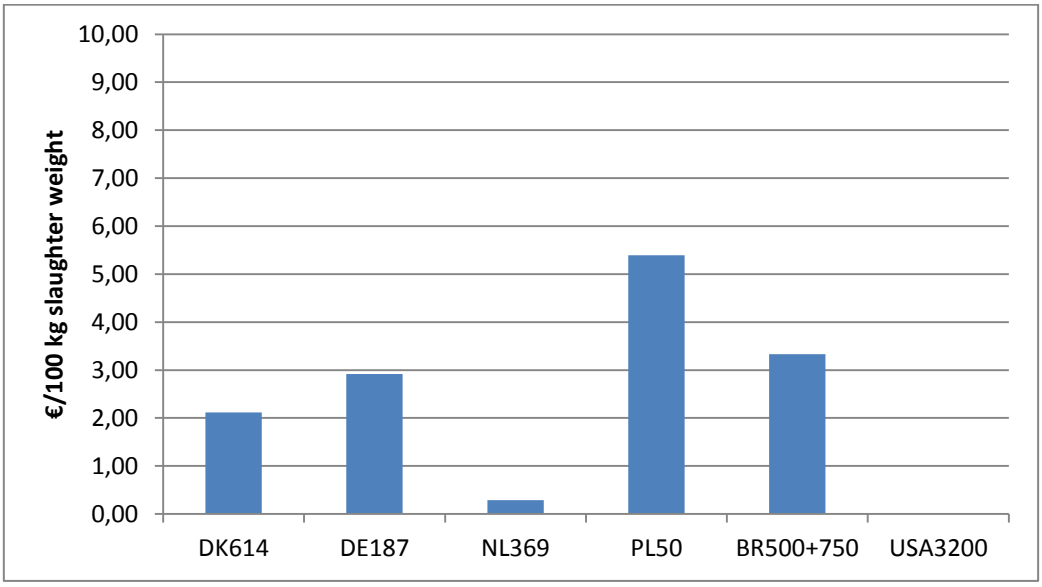
Regarding animal welfare, all EU Member States included in this study are suffering an increase in production costs related to the implementation of animal welfare legislation. The changeover to group housing of sows, the renovation of the floors, the introduction of enrichment material and low fibre feed have a relevant impact on the production costs in the EU Member States. The cost increase is particularly significant in Poland (+3.55%) as the pig farms are relatively small with respect to the size common to the other three EU Member States. In Denmark the cost impact is limited, as Danish legislation had already provided similar requirements years ago and there was time to upgrade the facilities. With regards to manipulable materials, the requirement applies to the Netherlands, yet the relative costs of compliance are negligible. The typical farms operating in the two Third Countries, on the other hand, are not affected by any animal welfare legislation. Farmers in Iowa are facing considerable pressure to change animal welfare practices to satisfy consumer preferences, but these can only be translated into requirements by private schemes.

Table 4.40 – Cost of compliance with food safety and animal health legislation for pigs in selected countries

food safety		unit	base	without	difference	% change
Denmark	DK614	€/100 kg SW	139.16	137.04	2.12	1.52
Germany	DE187	€/100 kg SW	152.76	149.84	2.92	1.91
Netherlands	NL369	€/100 kg SW	142.30	142.01	0.29	0.20
Poland	PL50	€/100 kg SW	125.66	120.27	5.39	4.29
Brazil	BR500+750	€/100 kg SW	107.92	104.59	3.33	3.09
USA	USA3200	€/100 kg SW	88.88	88.88	0.00	0.00

Own calculation

Figure 4.21 – Cost of compliance with food safety and animal health legislation for pigs in selected countries



Own calculation

Food safety legislation has a strong cost impact on the Polish pig farms. Most of the compliance costs are faced by the feed mills which transmit these compliance costs in the form of higher feed prices (+5%) to Polish pig farmers. A relevant increase of feed prices followed the compliance of the feed mills with EU legislation in the other EU Member States as well. This transmission of the compliance costs of feed mills into higher feed prices also occurred in Brazil with a cost impact of 3.09%. The regulations concerning the prevention of diseases have a much lower impact on production costs. Disease prevention regulations do not generally cause extra costs in Poland, because investments to comply with comparable standards were mostly implemented in response to national legislation antecedent to EU norms. Such costs are estimated to amount to 2.5 €/piglet and 15 €/sow.

The differences in production costs for pork between the EU and the Third Countries are substantial. Compliance costs with specific regulations in the fields of the environment, animal welfare and food safety do exert an impact on these differences, although to a limited extent. This fact is substantiated by the analyses discussed previously and summarized in Table 4.41 which distinguishes between the different pieces of legislation (for ENV only) and the various normative areas identified. The figures express the percentage change of the 'without legislation' scenario with respect to the base situation where the regulations are enforced. It has been found that the total effect of compliance costs ranges from 0.07% to 4.38%.

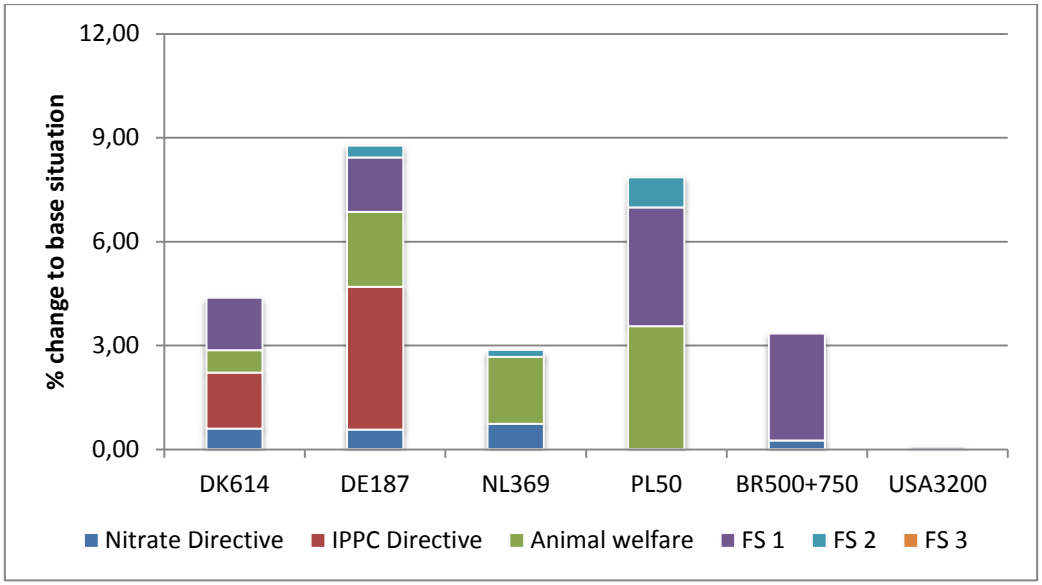
Figure 4.22 offers a tool to distinguish the directives with the greatest single influence on compliance costs. Note how most laws primarily affect European farmers. The Nitrate and IPPC Directives cause lower expenditures than the animal welfare and food safety 1 clusters.

Table 4.41 – Comparison of percentage change to base by normative area: pig meat

	Nitrate Directive	IPPC Directive	Animal welfare	Food safety 1	Food safety 2	Food safety 3	TOTAL
DK614	0.60	1.61	0.65	1.52	0.00	0.00	4.38
DE187	0.57	4.12	2.17	1.57	0.34	0.00	8.77
NL369	0.74	0.00	1.93	0.00	0.20	0.00	2.87
PL50	0.00	0.00	3.55	3.43	0.87	0.00	7.85
BR500+750	0.26	0.00	0.00	3.09	0.00	0.00	3.34
USA3200	0.07	0.00	0.00	0.00	0.00	0.00	0.07

Own calculation

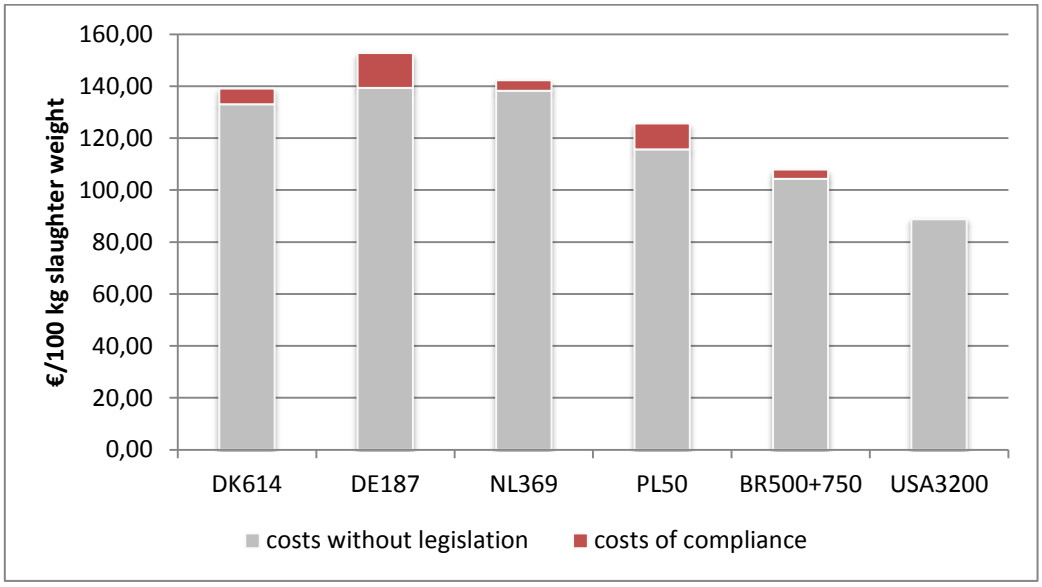
Figure 4.22 – Comparison of percentage change to base by normative area: pork



Own calculation

The discussion above is reflected and summarized in the figure below, which depicts an overview of the magnitude of the total costs of compliance with respect to total production costs.

Figure 4.23 – Cost at typical farm level with and without legislation



Own calculation

Note how the greatest impact is borne by the German and Polish typical farms. When these results are studied in the perspective of competitiveness, it clearly emerges that legislation in the fields of the environment, animal welfare and food safety does not significantly affect the competitive position of EU pig farms on the international marketplace. Although it is true that the cost of compliance is higher in the EU than in Brazil or the USA, production costs themselves are also higher for European typical farms. Therefore, the obligations set by the directives selected accentuate an existing disadvantaged position.

Compared to the other sectors analysed in this study, pig farms suffer higher compliance costs with legislation in the three policy fields. The percentage of changes in the selected EU Member States range from 3 up to 9%. This high level of compliance cost is to be attributed in particular to legislation in the field of the environment and animal welfare. The question may be posed as to why such big differences in compliance costs arise between EU Member States? The reasons are the following:

- Intensive pig farming in the Netherlands, Germany and Denmark, with high stocking densities, contribute to air and groundwater pollution. The costs of modification to adjust to environmental legislation are significant. Animal welfare legislation has induced a system change in the pig farms analysed, which has had a relevant impact on production costs.
- The cost of compliance with animal welfare legislation is particularly high in Germany and Poland, as the average farm pig farm is smaller than in Denmark and the Netherlands.

- The relatively low cost of compliance of Danish pig farms with animal welfare laws can be explained by the fact that Denmark anticipated legislation in animal welfare well before the EU regulated this field. Technological innovation carried out autonomously by the Danish pig farmers has been in line with the change in legislation and once new laws were adopted these affected only a minority of pig farms.

In Brazil and the US much less legislation has been issued affecting pig farms, either because of a lower concentration of pig farms or because there is less concern about the negative externalities of the production systems. The only exception is the relevant impact on feed prices of food safety legislation in Brazil.

The final result of the analysis is that the gap in pig production costs between the EU Member States and the Third Countries has been enlarged due to the cost of compliance with stricter EU legislation which add up to already existing differences in production costs. The differences in pig production costs between the EU Member States and Brazil and the USA are due to:

- Lower feed costs in Brazil and the US
- Lower labour costs in Brazil due to of lower wages and in the US because of very high labour productivity due to significant economies of scale as very large production units prevail

The differences in production costs between the EU Member States are of importance as well. Relatively low production costs are registered in the Denmark and in the Netherlands as the technical efficiency reached on these pig farms is quite high. Poland has low costs of production, but mainly because of the low level of wages. Finally Germany is lagging behind because of the relatively small farm size, which does not allow a full exploitation of economies of scale and because of the relatively high wages in this country.

4.5. Case study: Broiler meat

4.5.1. Choice of countries

In order to offer an extensive and detailed representation of the various aspects of the European Union's broiler sector, three member countries with different characteristics were chosen: France, Germany, and Italy. Two Third Countries – Brazil and Thailand – were also selected for comparison purposes. These countries are listed among the top-28 broiler producers in the world according to FAOSTAT (2012). Brazil is ranked 3rd following the USA and China, while Thailand, also an important producer, ranks 15th in the world. All the EU Member States follow, scoring respectively 18th (France), 24th (Italy) and 26th (Germany). The rationale that suggested including Brazil and Thailand as representatives of the Third Countries is their significant relationship with the European Union in terms of export volumes.

4.5.2. National farm structure

The table below shows the relevant figures to describe the broiler sector in the selected countries.

Table 4.42 – General information on broiler raising countries (2010)

	unit	FR	DE	IT	EU-27	BR	TH	World
Broiler meat production	1,000 tons	1,045	860	780	9,752	12,230	1,271	86,205
Broilers	1,000 birds	143,600	67,530	94,947	1,400,184	1,028,151	208,412	22,311,852
Broiler farms	units	41,720	4,530	13,210	-	1,413,612	7,541	-
Farms with ≥1,000 animals	units	8,880	1,100	1,780	-	28,562	7,538	-
Average farm size[1]	birds	25,071	56,854	52,864	-	16,000[2]	27,637	-
Currency		EUR	EUR	EUR	EUR	BRL	THB	-
GNI per capita	US$	34,970	38,410	31,930	-	10,980	8,480	-

[1] *farms with more than 1.000 birds*

[2] *farms with more than 1.000 birds in 2006*

Source: Eurostat, Faostat, national sources (2010 or latest available); for Brazil: IBGE and UBABEF

The largest European farms are located in Germany and Italy, where the average size is above 50,000 birds. These farms stand out when compared with the Third Countries analysed. However,

when compared to the others, these two countries have a smaller broiler population and a lower broiler meat production. Brazil is by far the leading nation in terms of production and broiler population, but the highest number of broiler farms is recorded in France

4.5.3. Typical farm structure

The analysis of compliance costs for the selected broiler meat producers has been conducted adopting an approach that theoretically defines a number of typical farms for each country. These farms result from a number of technical representative assumptions (discussed previously), that serve the purposes of this study and therefore they do not exist in reality.
A short description of the typical broiler farms included in the cost of compliance analysis, together with their most important characteristics, is provided in this section.

FR40kBRET: This typical broiler farm is located in Brittany and specializes in broiler production with a small cultivated area of 30 ha. The broiler unit is the main source of income, with a production surface of 3,000 m^2. This typical farm raises "heavy broilers" (average weight: 2.6 kg). We must note that not all farms in Brittany follow the same strategy, yet it is crucial to this study to have this system represented.
The farm is located in a "nitrate vulnerable zone" and houses more than 40,000 broilers; hence an impact study on compliance with the IPPC/IED directive had to be performed. The farm does not have enough land to spread its manure (with reference to the limit of 170 kg N/ha), but as the farmer prefers not to depend on other farmers to spread his manure, manure composting has been chosen as a strategy with the aim of selling the end product. Of the total production, 60 % of the compost is sold, and 40 % is used as an organic fertilizer on the farm.

FR40kPDL: The Pays de Loire typical farm has 56 ha of crops (mostly cereals) and a broiler unit of 2150 m^2, where "standard" broilers are raised. As in the Breton case, the farm has more than 40,000 broilers and had to do an impact study under the IPPC/IED directive. All the manure is spread on the cultivated area.

DE40kN represents an average broiler farm in the north of Germany, raising 40,000 birds per flock to a final weight of 2.2 kg. The number of flocks per year is 7.5, with a growing period of 37 days and an empty period in-between flocks of 10 days. The farm operates on 50 ha of owned and 50 ha of leased arable land, on which the excess litter is used as fertilizer.

DE30kS represents a medium broiler farm in the south of Germany, raising 30,000 birds per flock, of which 80% directly to a final heavy weight and 20% subjected to thinning (average final weight = 1.996 kg). The number of flocks per year is 7.4, with a growing period of 35 days and an empty period in-between flocks of 13 days. The farm is operating on 30 ha of owned and 30 ha of leased arable land on which the excess litter is used as fertilizer.

IT187kER represents a large broiler farm in Emilia-Romagna, with 187,000 birds kept on straw litter. It is a business farm where farming operations are performed exclusively by employees. The farm operates on 26 ha of owned land and the additional surface needed for litter management is either rented or managed through contracts. Alternatively, broiler litter may be transported to treatment plants or fertilizer-producing factories. The cycle consists of 6 flocks per year, with a growing period of 45 days and a 14-day empty period in-between. Each bird reaches a final live weight of 2.46 kg.

BR16kD: The domestic market-oriented (heavy broiler) farm is located in the southern Brazilian State of Santa Catarina and accounts for an average size of 16,000 birds, housed in facilities that on average cover a surface of 1,200 m^2. Family labour is employed for the broilers' care, except for loading operations, for which contracted labour is hired. Total land amounts to 15 ha, of which 6 ha are used for crops (corn in the summer and planted pasture in the winter) and 4 ha are used for natural pasture. Production is integrated by contracts. Slaughterhouses are responsible for feed, genetics, medications, technical assistance and logistics while producers are responsible for facilities, labour, energy, litter and manure handling. Excess manure is sold on a well-established regional market.

BR28kEX: This export market-oriented (standard broilers) farm is also located in Santa Catarina and raises 28,500 birds, housed in buildings with an average total area of 1,200 m^2. Family labour is employed for the operations connected with animal care, with the exception of bird loading operations, for which contracted labour is hired The area managed by the farm is similar to the previous typical farm (15 ha) since the land and crop production is not strictly linked to the livestock production. Production is integrated by contracts. Slaughterhouses are responsible for feed, genetics, medications, technical assistance and logistics, while producers are responsible for facilities, labour, energy, litter and manure handling. Excess manure is sold on a well-established regional market.

TH60k: Most of the broiler farms in Thailand tend to be contracted farms. In general broiler integrators, which produce broilers for both domestic and export markets, tend to contract larger sized farms of between 10,000 and 100,000 birds. About 90% of the farms are included in this class. The smaller, independent farmers generally produce for the domestic market. The typical farm considered in this study raises about 60,000 birds. The broiler houses are quite standard and can accommodate from 20,000 to up to 33,000 broilers per unit. The broiler houses are kept under evaporative cooling due to climatic conditions.

4.5.3.1. Typical farms: key variables of the broiler flock

Significant differences are detectable between the countries analysed, in terms of size of the broiler farms and levels of productivity, which will be discussed in the following paragraphs.

In Europe, the farms with more than 10,000 birds raise the majority of the animals. The same can be stated for the Third Countries: the data show that large farms, classed 10,000 to 100,000 animals per farm, raise the large majority of the broiler population (90% for Thailand).

In both groups of countries, the number of broiler farms and the broiler population are usually concentrated in specialized poultry regions.

Broiler farmers in EU Member States and Third Countries may be classified as follows:

- broiler integrators, who perform the complete vertical broiler business: i.e. broiler chicks and broiler production, feed production, slaughter house, marketing for retail and export;
- contracted broiler farmers, who have contracts to grow broilers for the broiler integrators;
- independent broiler farmers, who raise broilers independently, without any contract with the integrators.

Due to the high specialization of broiler farms, labour requirements show little differences between countries, ranging from 0.5 to 1 worker for each broiler unit.

Ross, Cobb, Arbor Acres and Hubbard are the dominant broiler breeds generally reared in the industry world-wide due to their high feed efficiency, high growth rate and good processing yield.

In the typical farms, the growing period varies from 35 to 45 days as a function of the final weight of the birds, which ranges from 1.460 to 2.625 kg, and to the feed conversion rate, ranging from 1.58 to 1.90 kg feed/kg live weight. At the conclusion of each breeding cycle, an empty period of 10 to 15 days is normally established for sanitation purposes.

4.5.3.2. Typical farms: production systems

The broilers are mostly kept in thermally-insulated, solid stables with forced ventilation (under positive or negative pressure) and thermostatically regulated heating or cooling systems set at a temperature in the comfort zone of the broilers. The stables are equipped with automatic feeders and (nipple) water drinkers for ad libitum feeding of the broilers and the minimization of labour required for the broiler production.

The broilers are all kept on the floor with bedding material, which is mainly woodchips and straw in the EU, and rice husk in Thailand. After harvesting, the litter is carried out of the farm and used as fertilizer on cropland, mainly outside the broiler farms, since most of them own little land. In Brazil, it is common practice to change the litter once a year (each 6 flocks for heavy broilers or each 8 flocks for standard broilers), with fermentation in between flocks under a plastic covering and chalk for 14 days. The one-year broiler litter is spread on the farms' own land or sold as organic fertilizer to neighbours or to fertilizer companies and cooperatives in a well-established market. In Thailand, the litter is removed after each crop of broiler production and sold as an organic fertilizer for cropland by the rice husk suppliers if the cloacal swab result is negative. Farmers have to pay for the transportation of the broilers' litter for disposal.

Broiler mortality varies between 3% and 5%, with a limited variation in the EU Member States (4.2% to 4.9%) and more extreme values in the Third Countries. The number of flocks (production cycles) per year varies from 5.48 in Brittany to 8 on the Brazilian export farm.

The broiler house stocking density in the European Union is regulated by the requirements of the Welfare Directive (2007/43/EC) for the protection of chickens kept for meat production, that establishes that the maximum stocking density must not exceed 33 kg/m^2, but may be raised up to 39 kg/m^2 or even 42 kg/m^2, if the farmer complies with specific high quality environmental and management requirements. According to the final weight and to mortality rate, this stocking density translates in 21 to 23 birds/m² on day 1. In order to comply with the maximum density requirement, the practice of "thinning" is applied, which usually implies taking out a certain number of females before the end of the production cycle. In France, however, since males and females are kept together, the practice also regards male birds. The rearing density in the Third Countries is lower due to the climate. In Thailand it reaches 10.4 to 11.0 broilers/m^2 while in Brazil the general figure is 13.3 broilers/m^2 on the farms for the domestic market, and 23.8 broilers/m^2 on the export-oriented farms.

Table 4.43 – Typical broiler farms: key variables of the broiler flock (2010)

	FR40kBRET	FR40kPDL	DE40kN	DE30kS	IT187kER	BR16kD	BR28kEX	TH60k
Region	Brittany	Pays de Loire	Niedersachsen	Southern Germany	Emilia-Romagna	Santa Catarina	Santa Catarina	Country
Number of birds/flock	63,000	49,450	40,000	30,000	187,000	16,000	28,500	60,000
Breed	Ross PM3 Hubbard	Ross PM3	Ross308 Cobb 500	Ross308 Cobb 500	Ross308 Cobb 500	Cobb/Ross	Cobb/Ross	Abor Acres, Ross, Cobb, Hubbard

Own calculation

Table 4.44 – Typical broiler farms: production systems

	FR40kBRET	FR40kPDL	DE40kN	DE30kS	IT187kER	BR16kD	BR28kEX	TH60k
Production system	Heavy weight	Standard broiler	Heavy weight	80% heavy weight 20% thinning	50% medium weight 50% thinning	Heavy weight	Standard broiler	Heavy weight
Average growing period (days)	44	37.5	37	35	45	42	30	40
Growing period total (days)	50	38.5	38.7	36.7	47	42	30	42
Empty period (days)	17	18	10	13	14	14	14	14
Feed conversion ratio	1.90	1.80	1.68	1.70	1.90	1.79	1.58	1.70
Stocking density / m^2 - Day 1	21.0	23.0	22.2	23.0	23.0	13.3	23.8	12.0
Average final live weight (g)	2,600	1,900	2,200	1,996	2,460	2,625	1,450	2,300
Mortality at farm level (%)	4.9	3.2	4.2	4.6	4.6	4.0	3.0	5.0
Number of flocks / year	5.5	6.50	7.5	7.4	6.0	6.3	8.0	6.0

Own calculation

4.5.4. Cost of production

The aim of the table and figure presented here is to offer an overview of the total cost of production, and the cost structure in the different countries analysed. The cost categories defined for the analysis (land cost, labour cost, capital cost and non-factor costs) are shown as stacked bars, whose summed height represents the total cost level. Broiler prices are shown, as a line.

Note that the aim of this section is to compare the typical farms on the basis of the base scenario, therefore showing the total production costs in 2010. The comparative analysis of production costs results from the chart and the table provided below. The table provides the absolute values per kg of the defined cost categories (land, labour, capital, non-factor costs) and reveals the specific differences for each category across the countries. The graphic representation adds clarity to the analysis, visualising the peculiarities of each typical farm.

Table 4.45 – Broiler production costs in selected countries, 2010

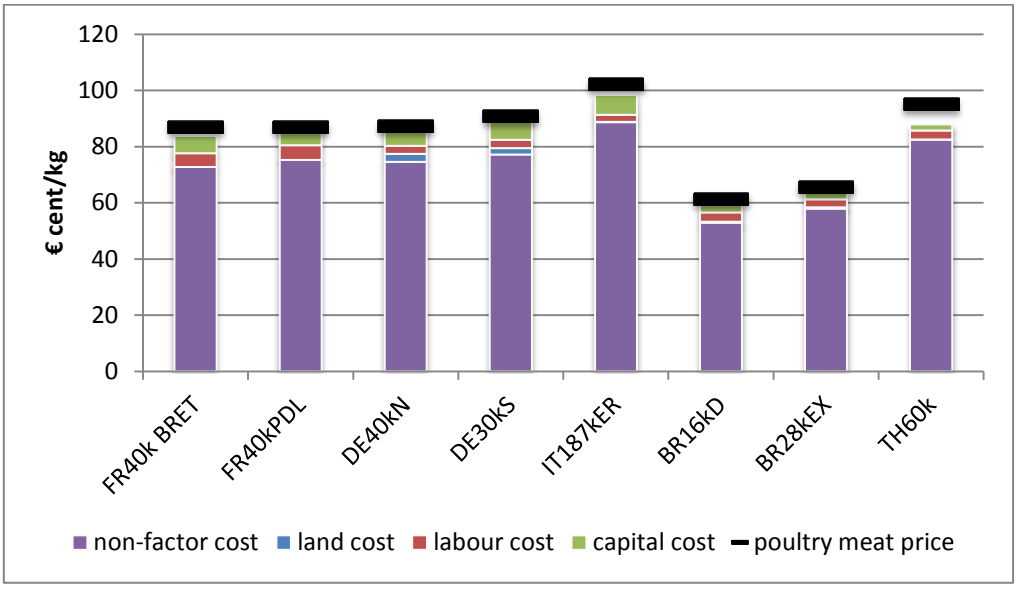
	unit	FR40k BRET	FR40k PDL	DE40k N	DE30k S	IT187k ER	BR16k D	BR28k EX	TH 60k
land cost	€ cent/kg	0.02	0.02	0.02	0.02	0.04	0.38	0.38	0.02
labour cost	€ cent/kg	4.90	5.20	2.90	3.00	2.60	3.31	2.89	3.13
capital cost	€ cent/kg	6.10	6.40	9.40	9.80	7.00	3.46	2.70	2.20
non-factor cost	€ cent/kg	72.78	75.28	74.60	77.20	88.76	52.92	57.99	82.60
total cost	€ cent/kg	83.80	86.90	86.92	90.02	98.40	60.07	63.99	87.95
broiler price	€ cent/kg	87.00	87.00	87.30	90.70	102.24	61.49	65.49	95.00

Elaboration by Peter van Horne

Sources: EMBRAPA Swine and Poultry (for Brazil)

The Brazilian broiler farmers producing for the domestic market (BR16kD) achieve the lowest production costs. Although the producers in Thailand have low labour and capital costs, their feed costs are comparable to the feed costs sustained by EU farmers. Therefore, their total production costs do not differ much from the costs registered in the EU. Among the typical farms in the EU, French farmers in Brittany (FR40kBRET) are the most competitive producing at rather heavy weights: the live weight is on average around 2.6 kg. Italian broiler farms have rather high production costs because of the higher feed prices in this country, which are 15% higher than in Germany and 20% higher than in France. These feed price differences are primarily due to differences in logistic infrastructure for producing feed. German broiler farms have higher production costs than those in France because of their higher capital costs, which can be attributed to more costly housing systems and to the slightly higher feed prices.

Figure 4.24 – Broiler production costs in selected countries, 2010



Own calculation

Table 4.46 – Production cost drivers: broiler meat

cost item	France	Germany	Italy	Brazil	Thailand
Labour (€/h)	17.72	15.00	14.48	2.15	1.11
Average feed price (€/ton)	276	288	332	215	400

Own elaboration

4.5.5. Selected legislation

The influence of the specific set of directives and regulations selected for the broiler case study on the economics of broiler meat production has been assessed. The 13 directives and regulations were chosen and clustered into the groups of the environment, animal welfare and food safety. Specifically, "the environment" (ENV) includes the Nitrate Directive and the Integrated Pollution Prevention and Control (IPPC) Directive, while "animal welfare" includes the Directive 2008/120/EC on chickens kept for meat production. "Food safety" (FS) is sub-clustered into two groups, covering aspects connected to feed mills and animal feed production, and the prevention and control of diseases.

The analysis is developed by means of a table which lists the farmers' actions as required by each piece of legislation and in which country these are to be applied.

4.5.5.1. *Legislation requirements*

An initial level of comparison contrasts the directives selected for the environment, animal welfare, food safety and animal health across their specific requirements. The inquiry discriminates whether these are applicable to each of the countries chosen, as well as if and how they were incorporated into the national set of norms. The aim of the table is to offer an immediate insight in the binding legislative conditions affecting broiler production. In light of this objective, the two Third Countries are included in the comparison together with the EU Member States in terms of their covering of equivalent environmental and food safety areas, without an explicit reference to their body of laws. The knowledge resulting from the analysis of legislative requirements sets the foundation for the subsequent analysis of the costs of compliance.

Table 4.47 – Specific normative requirements of selected legislation for broiler production

code	legislation	FR	DE	IT	BR	TH
ENV	**Nitrate Directive (91/676/EEC)**					
	o Nitrate Vulnerable Zones	x	x	x	o	o
	o establish fertilizer planning	x	o	x	o	o
	o max level of fertilizer for each crop	o	x	x	o	o
	o ban on application of chemical fertiliser/manure in autumn/winter	x	x	x	o	o
	o max level of N from manure (kg/ha/year)	170	170	170	o	o
	o special storage vessels for manure	o	x	x	o	o
	o special spreading conditions (i.e. max distance to water bodies)	x	x	x	x	o
	IPPC Directive (2008/1/EC)					
	o environmental integrated permit	o	o	x	o	o
	o use of BATs	x	x	x	o	o
	o ammonia emission limits	o	o	x	o	o
	o requirements on animal housing	x	o	o	o	o
AW	**Directive on Chickens kept for meat production (2007/43/EC)**					
	o maximum stocking density	x	x	x	o	x
	o minimum spillage of drinkers	x	x	x	o	o
	o availability of feed	x	x	x	x	o
	o permanent access to litter	x	x	x	o	o
	o ventilation to avoid overheating	x	x	x	x	x
	o heating/cooling systems for stocking density over 33 kg/m^2	x	x	x	o	o
	o maximum noise level	x	o	x	o	o
	o minimum light intensity	x	x	x	o	x
	o inspection of chickens	x	o	x	x	x
	o disinfection of materials and buildings	x	x	x	x	x
	o record keeping	x	x	x	x	x
	o limitations on surgical interventions	x	o	x	x	o

code	legislation	FR	DE	IT	BR	TH
FS1	**Directive on Undesirable substances in animal feed (2002/32/EC)**					
	o feed containing undesirable substances exceeding the maximum level (Annex I) may not be mixed for dilution purposes	x	x	x	x	x
	o complementary feeding stuffs may not contain levels of undesirable substances (Annex I) exceeding those for complete feed stuffs	x	x	x	x	x
	o ban on the use of animal protein as feed for ruminants	o	o	o	x	o
	o requirements hay production (sampling of feed)	o	o	o	o	x
	o requirements of manufacturing of citrus pulp bran	o	o	o	x	o
	Directive on Preparation, placing on the market and use of medicated feedstuff (90/167/EEC)					
	o medicated feeding stuffs may be manufactured from authorized medicated pre-mixes only	o	x	x	x	x
	o medicated feeds have to be prescribed, prepared and distributed by a vet/authority	x	o	x	x	x
	o keep daily records of production and distribution	x	o	x	x	x
	o requirements on production	o	o	o	x	x
	o requirements on packaging	o	o	o	x	o
	o requirements on labelling	o	o	x	x	x
	o max residue limits for veterinary drugs in foods	o	o	o	x	x
	o regulation for procedures of manufacturing and supplying of pesticides and veterinary medicines	o	o	o	x	x
	o procedures for the use, registration and commercialization of additives	o	o	o	x	x
	Regulation on Feed hygiene (183/2005)					
	o hygiene of production	x	x	x	x	x
	o hygiene of packaging and distribution	x	x	x	x	x
	o separate storage of hazardous materials	x	x	x	x	x
	o keep records of measures put in place to control hazards	x	x	x	x	x
	o source and use feed from registered establishments	x	x	x	x	x
	o register or be approved by the competent authority	x	x	x	x	x
	Regulation on Additives for use in animal nutrition (1831/2003)					
	o authorisation of a new feed additive or its novel use	x	x	x	x	x
	o registration of feed additives	x	x	x	x	o
	o requirements on labelling and packaging	x	x	x	x	x
	Regulation on Placing on the market and use of feed (767/2009)					
	o safety and marketing requirements	x	x	x	o	o
	Regulation on Animal by-products not intended for human consumption (1774/2002)					
	o substitution of animal proteins in feed with plant proteins	x	x	x	x	o
FS2	**Directive on Prevention of avian influenza (2005/94/EC)**					
	o notify authorities of the (suspected) presence of avian influenza	x	x	x	x	x
	o whole flock shall be killed in case of outbreak	x	x	x	x	x
	Directive on Prevention of Newcastle disease (92/66/EEC)					

code	legislation	FR	DE	IT	BR	TH
	o notify authorities of the (suspected) presence of Newcastle disease	x	x	x	x	x
	o whole flock shall be killed in case of outbreak	x	x	x	x	x
	Directive on Prevention of zoonoses and zoonotic agents (2003/99/EC)					
	o collect relevant and comparable data to identify and characterise hazards	x	x	x	x	x
	o keep records and report on results of analysis	x	x	x	x	x
	o proper identification of samples	o	o	o	x	o
	o monitor farms and slaughterhouses	x	x	x	x	x
	Regulation on Prevention of Salmonella (2160/2003)					
	o sampling and testing for zoonotic agents	x	x	x	x	x
	o implementation of good animal husbandry practices	x	x	x	x	x
	o routine veterinary supervision	x	x	x	x	x
	o registration	x	x	x	x	x
	o record keeping	x	x	x	x	x
	o documents to accompany animals when dispatched	x	x	x	x	x

Symbols: x = enforced in the country; o = no specific legislation

A. ENVIRONMENT

The **Nitrate Directive** applies to all the EU Member States studied: France, Germany and Italy. The aim of the Directive is the protection of ground and surface water from pollution caused by nitrates deriving from agricultural sources while additionally encouraging the adoption of good farming practices. In Brazil, some legislation at State level shows similarities with the Nitrate Directive, such as the requirement for storage capacity and environmental licensing. In Thailand, on the other hand, there is no specific environmental legislation for broiler farms.

The implementation of the Nitrate Directive in France, Germany and Italy takes place through the establishment of Nitrate Vulnerable Zones (NVZs). If a territory is classified as an NVZ, the producer must comply with an NVZ Action Programme, which includes a number of measures.

- There is a general ban on the application of chemical fertilisers or manure during autumn and winter. Organic manure or N fertilisers cannot be applied where the ground is waterlogged, flooded frozen hard or covered with snow.
- Slurry storage facilities with sufficient capacity must be available to cater to the period in which application is prohibited or alternative arrangements should be made.
- Crop requirement limits must be respected by not applying more N than a crop requires, taking into account elements like crop uptake, soil N supply, excess winter rainfall and plant or crop available N from organic manures.

- N fertilisers and organic manure should be spread as evenly and accurately as possible. Furthermore, they cannot be applied to steeply sloping fields or in a way that contaminates watercourses. Organic manures cannot be applied within 10 m of watercourses.
- Any material or fertiliser that contains N and is applied to the land must be considered in the N fertiliser calculations. Producers must keep farm and field records on cropping, livestock numbers, N fertiliser usage and manure usage, for a minimum of five years after the relevant activity has taken place.
- The Nitrate Directive, finally, limits the stocking rate to 170 kg N/ha per year.

The **IPPC Directive** is aimed at minimising the emissions of pollutants by means of the adoption of Best Available Techniques (BAT) and it affects the broiler farms located in the EU Member States that raise more than 40,000 birds. No equivalent legislation exists in Brazil or Thailand. The compliance costs related to this Directive are the costs of implementing the technologies (Best Available Techniques) listed in the Best Available Techniques Reference Document (BREFs) for broiler farms. It should be stated, however, that many of these technologies would have been adopted by the broiler farms anyhow in order to achieve better technical results.

B. ANIMAL WELFARE

The **Directive on Chickens kept for meat production** limits the stocking density of broilers in the stables to a maximum of 33 kg/m^2, but can be raised to up to 39 kg/m^2 when certain climatic conditions in the stable are satisfied. Minimum light requirements have to be respected in broiler housing, together with requirements on ventilation and temperature control systems, noise levels, and the availability of feed and water. It further limits surgical interventions on the animals, and prescribes the sanitisation of buildings and materials after each production cycle.

C. FOOD SAFETY AND ANIMAL HEALTH

There are two food safety and animal health groups considered in this study. The group "**Food Safety 1**" applies to France and Italy and it includes five directives and regulations, which directly affect feed mills as costs concerning the feed mill industry result in higher feed prices for the farm. In Germany the extra costs due to FS1 in this sector have been already absorbed by the feed mills, as these directives were already implemented by domestic German legislation. Note that some aspects of the Directives on Undesirable substances in animal feed and on Medicated feedstuffs are also relevant for Brazil and Thailand.

The group "**Food Safety 2**" applies to France, Germany and Italy and includes three directives and one regulation dealing with the prevention of the diseases: avian influenza, Newcastle disease, and zoonoses. The costs related to these directives and regulations refer to the prevention of the diseases and not the cost inherent to an outbreak of a disease. Typical compliance costs are therefore costs generated by obligatory vaccinations, costs related to the analysis of samples, administrative costs and veterinary costs. In both Brazil and Thailand, similar legislation that prescribes comparable measures to prevent the outbreak of diseases are also found.

4.5.5.2. Cost items list and potential impact at farm level by country

In the following table, the cost items generated by the implementation of the legislation at farm level are listed. The list is based on the information collected via the experts and the panels carried out in each country in order to identify real additional costs faced by the farmers in complying with the legislation. The cross indicates in which country the cost item was identified as compliance cost.

Table 4.48 – Comparison of legislative areas impacting cost of compliance in broiler production

	legislation	item	FR	DE	IT	BR	TH
ENV	Directive 91/676/EEC	minimum storage capacity	x	x	x		
		limit of 170 kg N/ha/year	x				
		transport of excess manure	x		x		
		costs for right to spread manure			x		
		additional fertiliser				x	
		low N feed			x		
	Directive 2008/1/EC	storage covering	x	x			
		BATs listed in BREF	x	x	x		
	Specific Third Countries	environmental licensing				x	
AW	Directive 2007/43/EC	lower meat production per m^2	x	x			
		expansion of light openings	x	x			
		extra ventilation and cooling	x	x	x		
FS 1	Directive 2002/32/EC	feed production	x		x	x	
FS 2	Food safety 2	disease prevention		x	x	x	x

Symbols: x = identified as compliance cost

4.5.6. Costs of compliance with selected legislation

The aim of this section is to analyse the costs of compliance with the legislations clustered as "the environment", "animal welfare" and "food safety" for the typical farms studied. Only the figures

referring to total costs are shown here. The analysis does not detail the cost items used above for the comparative analysis of production costs here, nor is revenue part of the objective at this point.

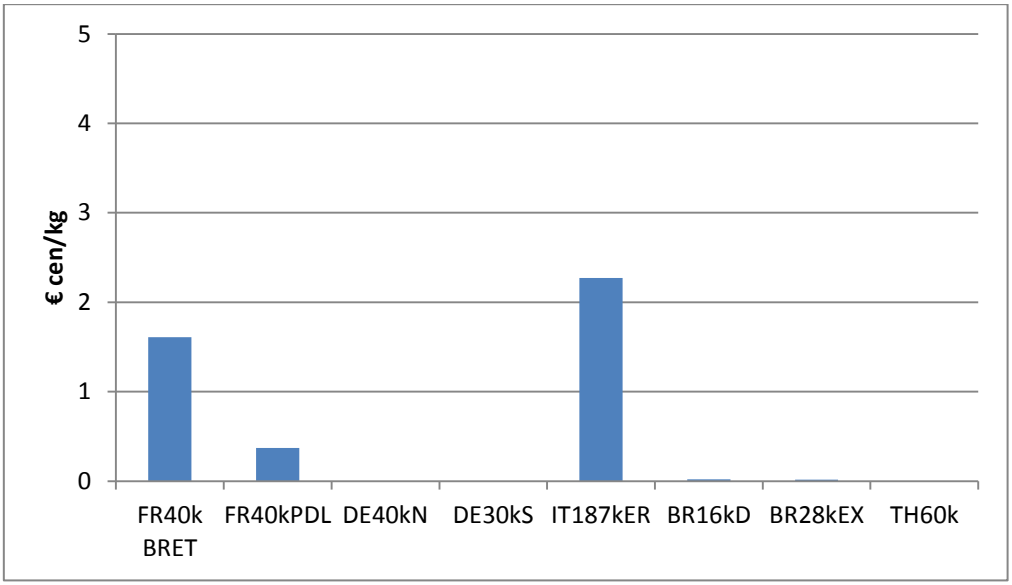
Table 4.49, Table 4.50 and Table 4.51 respectively, refer to the environment, animal welfare and food safety. Entries show the absolute values of the base scenario (with legislation) and the 'without' legislation scenario for each typical farm, as well as the absolute difference and the percentage change with respect to the base situation. The charts in Figure 4.25, Figure 4.26 and Figure 4.27 build upon the former value, visualising the total compliance costs that typical farmers face due to environmental and food safety legislations, respectively.

Table 4.49 – Cost of compliance with environment legislation for broilers in selected countries

environment		unit	base	without	difference	% change
France	FR40kBRET	€/100 kg SW	83.80	82.19	1.61	1.92
	FR40kPDL	€/100 kg SW	86.90	86.53	0.37	0.43
Germany	DE40kN	€/100 kg SW	86.92	86.92	0.00	0.00
	DE30kS	€/100 kg SW	90.02	90.02	0.00	0.00
Italy	IT187kER	€/100 kg SW	98.40	96.13	2.27	2.31
Brazil	BR16kD	€/100 kg SW	60.08	60.06	0.02	0.04
	BR28kEX	€/100 kg SW	63.99	63.97	0.02	0.03
Thailand	TH60k	€/100 kg SW	87.95	87.95	0.00	0.00

Own calculation

Figure 4.25 – Costs of compliance with environmental legislation for broilers in selected countries



Own calculation

The impact of environmental legislation on broiler production costs varies significantly between countries. As far as environmental legislation is concerned, the broiler farms in Italy have to face compliance costs which are primarily due to the Nitrate Directive. The transport of excess manure and the use of low protein feed have a significant impact on the broiler farms' finances in this country. In France the environmental compliance costs are much lower, but there is a relevant difference between the two typical farms: in Brittany the high density of livestock farms and the limited land area of the broiler farms in this region generate higher costs of compliance than in the more extensive livestock area of the Pays de la Loire. In Germany the valorisation of the manure by a biogas plant generates revenues which are able to compensate the costs of compliance with the Nitrate Directive and the IPPC Directive. Note that the same strategy is not attractive for the pig sector, due to different performance quality of pig and broiler manure. In fact, the latter yields seven times as much biogas as the former. Besides, plants run on pig manure do not reduce the surplus of nitrogen and phosphorus, forcing farmers to still bear costs for the transfer of these surpluses. Hence, biogas processing has an impact on the costs of compliance with the Nitrate Directive and the IPPC Directive only in the broiler sector.

In Brazil and Thailand there is no environmental legislation which has a significant impact on the production costs of broiler meat. In Brazil, environmental legislation is established both at Federal and State level; however its impact on production costs is limited, due to the existence of well-structured regional markets for broiler litter. The ban on the application of chemical fertilisers and manure in autumn and winter is not applicable, since the country has winter crops which require fertilisation. Several Brazilian regions have two crops per year, and some even three.

Table 4.50 – Cost of compliance with animal welfare legislation for broilers in selected countries

animal welfare		unit	base	without	difference	% change
France	FR40kBRET	€/100 kg SW	83.80	83.80	0.00	0.00
	FR40kPDL	€/100 kg SW	86.90	86.13	0.77	0.89
Germany	DE40kN	€/100 kg SW	86.92	85.62	1.30	1.49
	DE30kS	€/100 kg SW	90.02	89.42	0.60	0.66
Italy	IT187kER	€/100 kg SW	98.40	99.50	-1.10	-1.22
Brazil	BR16kD	€/100 kg SW	60.08	60.08	0.00	0.00
	BR28kEX	€/100 kg SW	63.99	63.99	0.00	0.00
Thailand	TH60k	€/100 kg SW	87.95	87.95	0.00	0.00

Own calculation

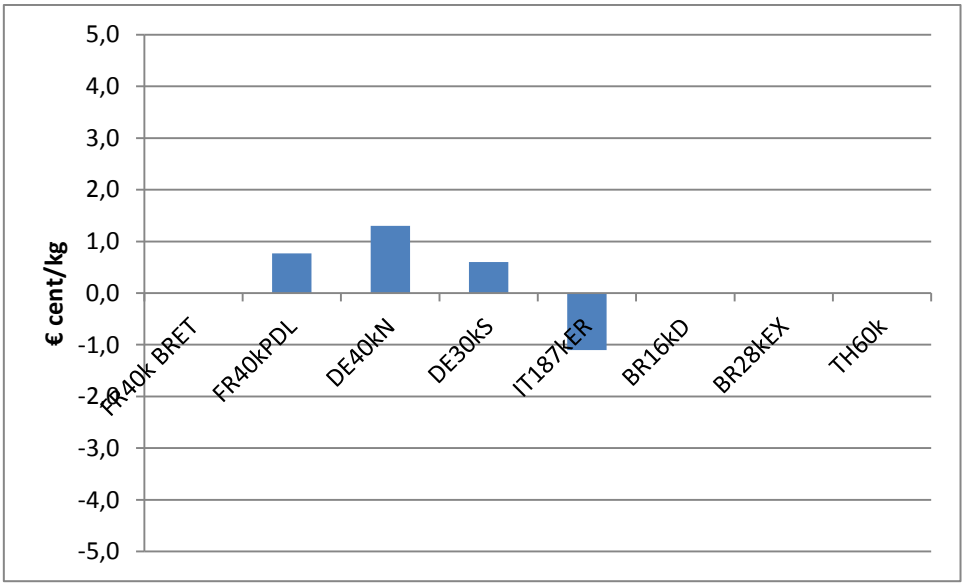
The EU legislation on animal welfare of chickens kept for meat creates a very different impact in the three EU Member States analysed in this study. In Italy, for example, the typical broiler farm

currently, raises the broilers at a stocking density of 33 kg/m^2 due to hot summers. Taking advantage of the opportunity given by the EU legislation, many of the broiler farms in Italy will opt to increase this density to up to 39 kg/m^2 by investing in extra ventilation technology and cooling facilities. By adopting this strategy, the increased production per m^2 will compensate the extra costs related to the necessary investments and as a result the production costs in this country will slightly decline thanks to the EU legislation on broiler welfare. Following the EU welfare directive, investments in Germany had to be made for the construction of light openings in the stables and the stocking density had to be decreased from 42 to 39 kg/m^2. This generated extra costs for the broiler producer ranging between 0.66% in the south up to 1.49% in the north of Germany. The French broiler producers in the Pays de la Loire are also facing extra costs related to compliance with the AW directive, as they must reduce their stocking density as well.

In Italy, for example, the typical broiler farm will now, for climatic reasons (hot summers), take advantage of the opportunity given by the EU animal welfare directive by adopting this strategy.

Animal welfare is not a relevant issue in Brazil and Thailand, as in both countries the stocking densities are rather low due to climatic reasons. In these circumstances, a higher density would be economically inconvenient as mortality would rise significantly.

Figure 4.26 - Cost of compliance with animal welfare legislation for broilers in selected countries



Own calculation

As far as the food safety legislation is concerned, the investments in the feed industry affect farmers in the form of higher feed prices. This occurs in Italy, France and Brazil, where production costs would decline if the feed industry did not have to comply with this legislation. In Germany an

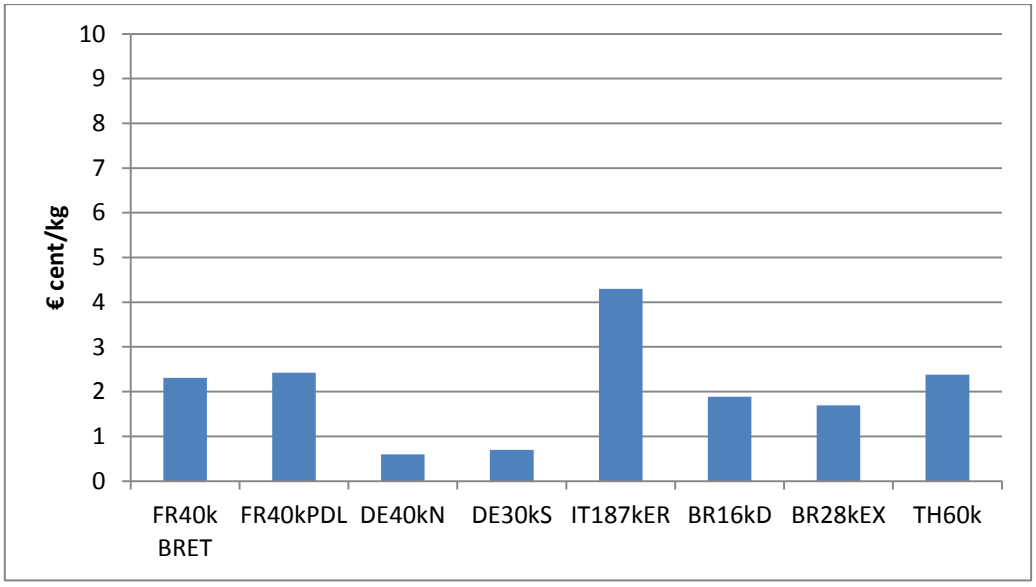
impact is also registered, though more limited than for the other typical farms analysed. A lower cost impact has been registered for the prevention of diseases in broiler farms. These costs are related to vaccinations, analysis of samples and veterinarian visits. The compliance costs vary from 1.32% in Italy down to 0.26% on the Brazilian export farms. It should be noted that this is the only category of legislation which also generates relevant compliance costs for the broiler farms in Thailand. The costs are related to compliance with the standard for Assured Chicken Production (ACP) practices which prescribe a bio-security plan and disease surveillance and control in NAI free areas. These costs have a 2.71% impact on production costs.

Table 4.51 – Cost of compliance with food safety and animal health legislation for broilers in selected countries

food safety		unit	base	without	difference	% change
France	FR40kBRET	€/100 kg SW	83.80	81.49	2.31	2.76
	FR40kPDL	€/100 kg SW	86.90	84.48	2.42	2.78
Germany	DE40kN	€/100 kg SW	86.92	86.32	0.60	0.69
	DE30kS	€/100 kg SW	90.02	89.32	0.70	0.77
Italy	IT187kER	€/100 kg SW	98.40	94.00	4.30	4.37
Brazil	BR16kD	€/100 kg SW	60.08	58.19	1.88	3.14
	BR28kEX	€/100 kg SW	63.99	62.30	1.69	2.64
Thailand	TH60k	€/100 kg SW	87.95	85.57	2.38	2.71

Own calculation

Figure 4.27 – Cost of compliance with food safety and animal health legislation for broilers in selected countries



Own calculation

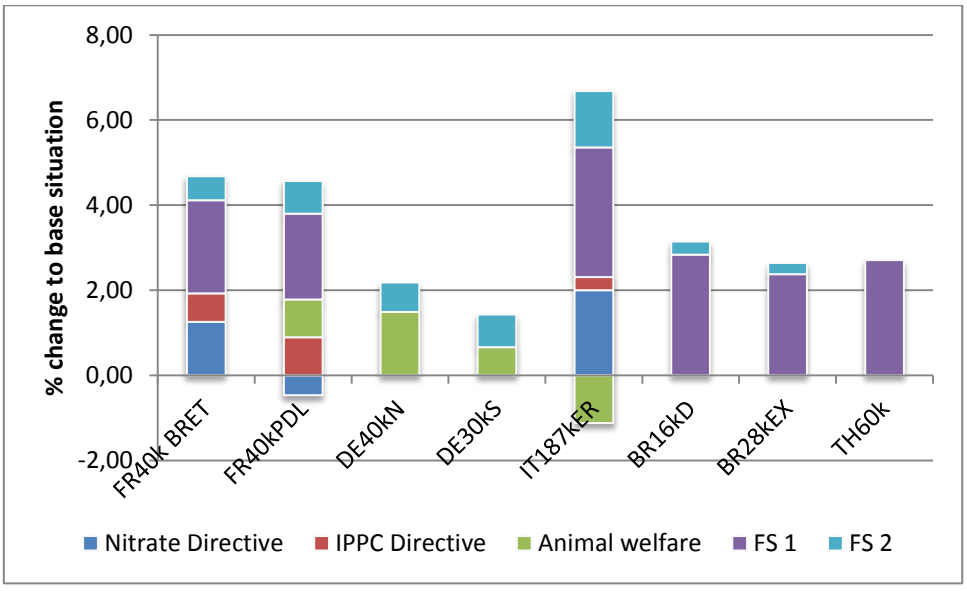
Table 4.52 and Figure 4.28 offer a final comparison among the three normative areas investigated for the broiler sector. They provide more detailed information about the environment, animal welfare and food safety areas in terms of percentage change with respect to the base situation. The compliance costs with environmental legislation distinguish between the Nitrate Directive and the IPPC Directive, while for food safety, the indirect costs of the feed mills transmitted to the farmers and the compliance costs related to the prevention of diseases have been separated.

Table 4.52 – Comparison of percentage change to base by normative area: broiler meat

	Nitrate Directive	IPPC Directive	Animal welfare	Food safety 1	Food safety 2	TOTAL
FR40kBRET	1.25	0.67	0.00	2.20	0.56	4.68
FR40kPDL	-0.47	0.90	0.89	2.01	0.77	4.10
DE40kN	0.00	0.00	1.49	0.00	0.69	2.18
DE30kS	0.00	0.00	0.66	0.00	0.77	1.43
IT187kER	2.00	0.30	-1.12	3.05	1.32	5.56
BR16kD	0.04	0.00	0.00	2.84	0.30	3.14
BR28kEX	0.03	0.00	0.00	2.38	0.26	2.64
TH60k	0.00	0.00	0.00	0.00	2.71	2.71

Own calculation

Figure 4.28 – Comparison of percentage change to base by normative area: broiler meat



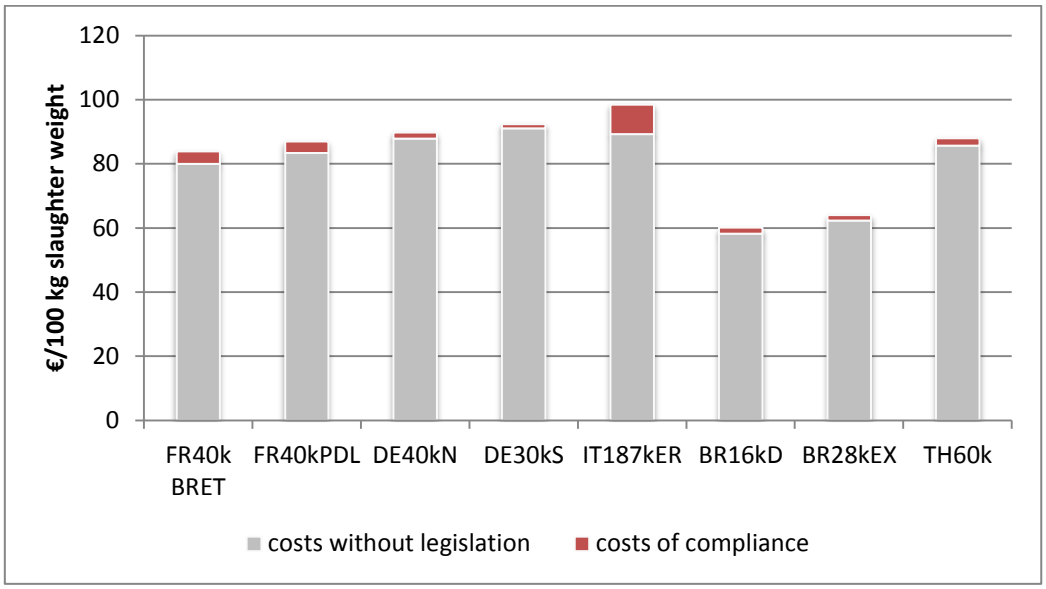
Own calculation

Note how regulations concerning the protection of the environment and animal welfare only affect the EU, and no costs are met with in Third Countries. For the EU broiler farmers, the impact of these norms is nonetheless limited: the Nitrate Directive constitutes a significant cost centre in Italy

and in Brittany (FR), whereas in the French PDL typical farm, the absence of the directive would cause costs to increase (expressed by the negative value of -0.47%), as the Nitrate Directive has created a stimulus to the broiler farm to improve its use of broiler manure which creates a net benefit. The cost impact of the IPPC Directive is higher in France than in Italy. The Directive on the welfare of chickens kept for meat production constitutes an important cost factor for the DE40kN typical farm, where costs are notably higher than in the south of Germany and France, while its absence would weaken the competitive position of the Italian typical farm. Compliance with the food safety legislation which affects feed mills ranges from 2.01% (France) to 3.05% (Italy) in the EU, and from 2.38% to 2.84% in Brazil (but no costs in Thailand, since the legislation has also applied to broiler production for domestic consumption). The costs related to the prevention of diseases also have a higher impact in Italy among the three European typical farms and in Thailand among the Third Country farms.

A final level of analysis is the comparison between the total costs with and without legislation. This comparison is offered in the figure below.

Figure 4.29 – Comparison of production and compliance costs for broiler meat



Own calculation

As anticipated by the discussion on the figures presented in this chapter, the greatest impact on broiler production costs due to the legislation selected is registered in Italy, and the lowest in the south of Germany. However, a different picture emerges when this outcome is analysed considering its relationship to the costs without legislation. In fact, these costs are generally higher in the EU

than in Brazil and Thailand, with the sole exception of Germany, whose cost level is lower than Thailand's though still higher than Brazil's. It follows that the disadvantage of EU farms on the international marketplace is not entirely due to the legislation in the fields of the environment, animal welfare and food safety, but regards other factors.

In comparison with the other cost components of the total production costs, the compliance costs with legislation of broiler farms are relatively limited. Most of the compliance costs are administrative costs which implies labour time dedicated to control functions or to costs for paying consultants to draw up the manure spreading plans foreseen by the legislation.

Another important reason for the limited role of compliance costs in the total production costs of broilers is that certain techniques which are prescribed by legislation have already been adopted by the broiler farm. This is particularly true for the techniques foreseen by the BREF of the IPPC Directive. Legislation can also generate benefits when the broiler farmers acquire a better awareness of the value of broiler manure (Pays de la Loire) or when under certain conditions, it is economically convenient to increase the stocking rate (Italy).

Differences in compliance costs between Member States arise since the production systems and the natural and institutional context of the farms are very different. Producing broilers in an area which is already densely populated with livestock farms (e.g. Italy and Brittany) generates higher compliance costs with environmental legislation for the single broiler farms than for farms located in areas with primarily arable cops and pastures (Pays de la Loire, Germany). Differences in labour costs between Member States also explain part of the differences in compliance costs.

The effect of implementing the EU legislation does not significantly affect the competitive position of the EU broiler farms as other factors are more relevant.

The main factors explaining the strong competitive position of Brazil and Thailand are:

- The low wages and the low cost housing systems due to the warmer climate
- The low feed cost, particularly in Brazil
- The lower broiler density on the broiler farms in these two countries which explains their compliance with EU legislation on animal welfare

These cost advantages largely compensate for the smaller flock size and the lower stocking density in these countries which creates diseconomies of scale. The large broiler farms with high stocking densities in the EU have difficulties to compete on costs with the lower priced broilers from these two countries. The high reliability of the EU broiler production due to the compliance with food safety legislation however strengthens the role of EU broiler meat on the world market.

4.6. Case study: Wheat

4.6.1. Choice of countries

In order to represent all the different aspects of the wheat market as representative of the cereals sector of the European Union four member countries with different characteristics were chosen. Two Third Countries were selected as well for comparison purposes. The selection adopted the criteria illustrated previously. On the basis of these criteria, the countries investigated for the wheat sector are: Denmark, Germany, Hungary, the United Kingdom, Canada and Ukraine.

Denmark ranked 23rd among the major wheat producers in 2010. Between 2006 and 2010 the surface devoted to wheat increased from 686,000 ha to 764,000 ha. The country is a net exporter, as exports (1.5 million tonnes) exceed imports (0.29 million tonnes). Main export destinations in 2009 and 2010 were other EU States as well as the USA, Korea and the Philippines. The yield has varied over recent years and averaged at 6.6 t/ha in 2010. Denmark shows high environmental protection standards, which also influence wheat production (section 1.5).

Germany was the 6th largest wheat producer in the world in 2010, with nearly 9 million tonnes of wheat exported. Large amounts of wheat were directed to the Netherlands and to Belgium before shipping to their final destinations. South Africa, as well as Saudi Arabia, were among the top-5 export destinations. The area harvested has remained generally stable during the last years (Ø 3.2 million ha), whereas yield has been fluctuated slightly averaging at 7.3 t/ha in 2010.

Hungary ranked 28th in the list of the main wheat producing countries in 2010. The harvested area increased during the last years to 1.15 million ha in 2009, but fell to 1.01 million ha in 2010. Hungary is clearly an export-oriented country: in 2010, it exported nearly 1.9 million tonnes of wheat to neighbouring countries within the EU and Bosnia-Herzegovina in the Balkans.

The United Kingdom is one of the 20 most important wheat producing countries in the world. During recent years, the wheat acreage has increased slightly to 1.9 million ha, while yield has varied and reached 7.7 t/ha in 2010. In 2010, the UK was a net wheat exporter (2.2 million tonnes) to EU Member States. Main imports originated from Canada and the USA.

Canada is the 8th largest wheat producing country in the world. In terms of wheat trading, the country is clearly export-oriented, and imports are of only minor relevance. Its trading partners are the USA and Mexico in North America, though exports are directed to various countries across the

Pacific Ocean (i.e. Bangladesh, Sri Lanka, Japan, Korea and Indonesia) as well. European Member States do not appear in the top-5 list of destinations in 2010.

Ukraine ranks 11th in global wheat production and is clearly an export-oriented country. During the last two years, exports amounted to 4-5 million tonnes. Destinations are the countries around the Mediterranean Sea, such as Egypt, Tunisia, Israel, Turkey and Italy. Wheat acreage has increased in recent years, averaging 6.3 million ha. Yields improved slightly over the years and reached an average of 2.7 t/ha in 2010. Environmental regulations are less restrictive than in the EU.

4.6.2. National farm structure

The countries selected for the case study represent 10% of worldwide wheat production (653.6 million tonnes according to FAOSTAT 2013) and 29% of the total exports (124 million tonnes according to UN Comtrade 2013). In the following, the intensity of production as reflected by yield, and the national farm structure as reflected by the average farms size, are described. The major characteristics for the wheat producing countries analysed in this chapter are presented (Table 4.53) adopting a general perspective.

In Denmark the average yield in 2010 was 6.6 t/ha, leading to a total of 5.1 million tonnes on 0.8 million ha. The total number of cereal growing farms has resulted in a relatively small average farm size of 65 ha, yet more than 60 % of the crop acreage was harvested in holdings with more than 100 ha.

In Germany 24.1 million tonnes of wheat were produced on 3.3 million ha in 2010, resulting in an average yield of 7.3 t/ha. In total, 229,000 farms with an average crop land size of 52 ha were growing cereals. However 60 % of the crop land was harvested by farms larger than 100 ha. Note that farm structure differs between Western and Eastern Germany. In Lower Saxony (Western Germany) the average size is 67 ha and 49 % of the land belongs to farms larger than 100 ha. In Mecklenburg-Western Pomerania (Eastern Germany) the average size is, on the other hand, 291 ha, and 40% of the agricultural land belongs to farms larger than 1,000 ha.

In Hungary 3.8 million tonnes of wheat were harvested in 2010 and the average yield was 3.8 t/ha. While the average farm size is generally rather small (12 ha), two thirds of the cereal acreage was to be found on holdings larger than 100 ha. Such differences in terms of farm size were the largest registered among the EU Member States analysed for the case study.

In the United Kingdom the harvested wheat acreage was 1.9 million ha, with an average yield of 7.7 t/ha. More than 91,000 farms with an average size of 65 ha were growing cereals. In terms of production, more than 75 % of the crop acreage was harvested by farms larger than 100 ha.

In Canada and Ukraine, both farm structure and yield levels are comparable. The former is characterised by an average yield of 2.8 t/ha in 2010, with an average farm size of 180 ha, although the wheat growing Prairie farms are, on average, 241 ha. However, a substantial number of large scale Canadian farms exist and in 2011 12% of the Prairie farms cultivated between 423 and 809 ha, while 11 % cultivated more than 809 ha.

In Ukraine, a low input system leads to an average yield of just 2.7t/ha in 2010. The average farm size is 290 ha while 60 % of the crop land is farmed by operations larger than 1.000 ha.

Table 4.53 – General information on wheat producing countries (2010)

	unit	DK	DE	HU	UK	EU27	CA	UA	World
Harvested area	million ha	0.80	3.30	1.00	1.90	26.47	8.30	6.30	217.06
Production	million tonnes	5.10	24.10	3.80	14.90	139.18	23.20	16.90	216.97
Yield	ton/ha	6.60	7.30	3.70	7.70		2.80	2.70	
Exports	million tonnes	1.40	8.90	1.90	3.30		15.50	4.90	
Farms	1,000 units	37	229	317	91		52	39	
Average farm size*	ha	65	52	12	65		178**	291	
Exports/production	%	28	37	50	22		67	29	
Currency		EUR	EUR	EUR	GBP	EUR	CAD	UAH	-
GNI per capita	$	41,540	38,410	19,720	35,590	-	38,400	6,590	-

** Total crop land divided by number of crop farms*

*** Total acreage of wheat divided by total number of wheat farms*

Source: EUROSTAT, FAOSTAT, UNComtrade, STATCAN, UKRSTAT

4.6.3. Description of the typical farms

The compliance costs for wheat were analysed by a set of typical farms for each country. Each typical farm represents a farm which produces the major share of wheat within the countries considered. The farms were set up by a standard operating procedure described in Chapter 3 and do not exist in reality. For the EU, two typical farms were selected for Germany and Denmark and one for Hungary and the United Kingdom. For the Third Countries two Canadian and Ukrainian farms were chosen. The typical farms are described in four tables:

Table 4.54 presents some general information about the farms and the natural conditions characterising the regions of the typical farms.

Table 4.55 the production systems in terms of yields and nitrogen inputs are described for each crop. Table 4.56 and Table 4.57 describe the crop portfolio of the farms. The typical wheat farms can be described as follows:

DK700FYN represents a typical farm in the central area of Denmark, on the island of Fynen. The soil is mainly sandy loam (USDA system) with a clay content of about 15 percent. Average annual temperature is 8.1°C and average annual precipitation is 639 mm. The rather good soil and short distance to the coast (lower risk for night frost in the late spring) provide good conditions for production of grass and garden seeds. The farmer of the private company owns about 80% of the land. The average field size is about 20 ha. The tillage system is intensive with conventional ploughing prevailing. Main crops are winter wheat (150 ha), malting barley (190 ha) and grass seeds (170 ha). Due to the nitrogen quota system, the nitrogen input of 150 kg for wheat is lower than that of the German and UK farms. Even with the comparable low N-Input, a wheat yield of 8 ton/ha is achieved, and a risk of nitrogen leaching exists.

DK1200SL represents the larger Danish farm with 1,230 ha of arable land. The farm is located on the island of Lolland in the southeast of Denmark. This island has some of the most fertile soil within Denmark. The soil is manly sandy loam with a clay content of about 20%. The average annual temperature is 8.1°C and the average precipitation 584 mm. As the farm is located in the very south of Denmark, it has more annual hours of sunshine than the country in general. As the farm is close to a sugar beet processing plant, it has more than 20 % sugerbeets in its rotation. The farm and the entirety of the arable land belong to two owners. As on the other Danish farm, the average field size is 20 ha and a conventional tillage system with ploughing or deep soil cultivation is applied. Besides sugar beets, the main crops are winter wheat (370 ha), malting barley (185 ha), barley (106 ha), grass seed (94 ha) and rapeseed (80 ha). The nitrogen level for winter wheat is about 165 kg/ha which leads to a yield of 8.1 t/ha. Due to the high precipitation nitrogen can leach during winter.

DE120HI represents a typical arable farm in the peripheral region of the “Hildesheimer Börde” in Western Germany. This is the area with the most fertile soils in Germany. The soils have a loess layer of 2 m. The average annual temperature is 9.2°C and precipitation is 700 mm. These conditions are very favourable for arable production. Roughly 50 % of the precipitation falls during the summer (April to September). Due to the high soil quality and good climate conditions, the

region is one of the main production areas for sugar beets. The farmer owns 60 ha of arable land and rents another 60 ha, thus farms 120 ha. Historically, the region is composed of smaller family farms and the average field size is just 3 ha. Main crops are winter wheat (72 ha) and sugar beets (25 ha). The farmer uses a conservation tillage system with reduced stubble breaking and mulch-seed. In the cultivation of wheat, 195 kg nitrogen are applied and lead to a yield of 9.4 t/ha. Nitrogen can leach during winter time as the level of precipitation from October to March is 330 mm. The favourable growing conditions and high yield levels also lead to higher herbicide and fungicide application rates compared to production systems in regions with a continental climate.

DE1100MVP represents a typical arable farm in the county "Nordwestmecklenburg" in Mecklenburg-Western Pomerania (north- east of Germany). The prevailing soils are sandy loams and loamy sands. Therefore the soil fertility is much lower than on the smaller German farm, though good when compared to those within north-western Pomerania. As the county is located in proximity of the Baltic Sea, the climate is maritime. Compared to the "Hildesheimer Börde", the average annual temperature of 8.5°C and the average annual precipitation of 630 mm are a little lower. Due to the lower temperature and less fertile soils, sugar beets are rarely grown. In this region the most important leaf crop is rapeseed. The typical farm belongs to a cooperative which emerged from a cooperative (LPG) in the former GDR. The arable land of 1,090 ha is almost entirely rented. Due to the land reform in the former GDR, the arable field size is about 25 ha. The main crops are wheat (475 ha), rapeseed (292 ha) and corn for silage (173 ha). Wheat is grown with a conservation tillage system with reduced stubble breaking and mulch seed. The wheat yield is 8.9 t/ha. Due to the high nitrogen input of 230 kg/ha and a precipitation level from October to March of almost 300 mm, nitrogen can leach during winter time.

HU1100TC represents a larger commercial farm in Hungary. The farm is located at the border of three counties: Somogy, Tolna, and Baranya, in the region called "Külső-Somogy". The soils are of good quality and have a sandy layer which is covered with brown forest soil. The average annual temperature is 10.5-10.6°C and the average precipitation is 650-700 mm, which is quite good for arable production. Most of the precipitation falls between April and June. The farm is a former socialist-type cooperative owned mostly by its workers (former cooperative members). Therefore the arable land is entirely rented. Due to the land reform during the socialist period, the average field size is about 45 ha. An intensive tillage system with prevailing conventional ploughing is used. Corn is the main crop and is planted on 40 % of the arable land. Other important crops are winter wheat (330 ha) as well as barley and rapeseed (each 110 ha). The nitrogen input (140 kg/ha) for

wheat and the wheat yields (4.9 t/ha) are lower than on the western European farms. Anyhow nitrogen can still leach during winter.

UK400SUFF represents a typical arable farm in central Suffolk. The principle soil type is Hanslope series, chalky boulder clay. This slowly permeable, calcareous, clayey soil is well structured and retains moisture and nutrients. However, the relatively high clay content makes the soil unsuitable for root crop or vegetable production. The climate is classified as maritime with an average annual temperature of 10.2°C and average annual precipitation of 650 mm, making this one of the drier parts of the United Kingdom. The combination of favourable soils and climate make this one of the principle wheat production areas of England. On these soils, wheat is typically grown in rotation with break crops such as oilseed rape and beans. However, the growing conditions also provide ideal conditions for blackgrass (*Alopecurus myosuroides*), which is costly and difficult to control. The farm has 400 arable ha, of which 92% is owned by a limited company. The average field size is 15 ha. Wheat (224 ha) is the dominant crop and is produced in a no-till system with direct seeding. A nitrogen input of 200 kg/ha leads to wheat yields of 8.9 t/ha. As on the other EU farm nitrogen can leach during winter.

CA1700SAS represents a typical farm located in the north eastern part of the province in the “black soil zone” of Saskatchewan. This area contains the most fertile soils within Saskatchewan. The black chernozemic soils typically have 4.5 to 5.5 % of soil organic matter (SOM) with some soils having an SOM as high as 8 to 10 %. The average annual temperature is approximately 2 degrees. Although precipitation averages only 400mm, shorter and cooler summers with less drying winds means that its moisture deficit is the lowest in the province. Typically there is a preference for rapeseed as a feature of good rotation practices. Hard red spring wheat is the main wheat type. Other annual crops commonly grown include flax, linseed, barley, oats, rye and field (dry) peas. Two farmers are required to operate the typical farm of 1,700 ha of arable land. They rented one third of the land. The average field size is 100 ha. Tillage practices have shifted substantially to direct seeding and minimum tillage and this farm incorporates a no-till system. The crop portfolio is rather diverse. Main crops are summer wheat (344 ha); rapeseed (343 ha) and barley (343 ha). Other important crops are linseed (258 ha) and other pulses (258 ha). Due to the short growing period and low precipitation level, just 60 kg/ha of nitrogen are applied for wheat. The wheat yield is 2.8 t/ha and is much lower than in Western Europe. Due to the low nitrogen input per ha and the cold and dry winter the risk of nitrogen leaching is lower than on the EU-farms.

CA6000SAS represents a larger farm in the south western part of the province in the "brown soil zone". The brown chernozemic soils have typically 2.5 to 3.5% soil organic matter. Although precipitation averages around 377mm, longer and hotter summers with drying winds mean that its moisture deficit is the highest in the province. The average annual temperature is approximately 4 degrees. Soil productivity varies considerably within this region and because of increasing weather variability, yields are highly variable ranging from drought with little or no harvestable yield to wheat yields in excess of 4 tonnes per hectare. Typically there is a preference for durum over hard red spring wheat. Other annual crops commonly grown include flax, linseed, malting barley, oats, lentils and chick peas. The typical farm consists of 6,000 ha of arable land of which three quarters is rented. The average field size is 300 ha. A no- till system is also implemented on this farm. The crop rotation is very diverse. Main crops are durum (1,000 ha), summer wheat (800 ha), rapeseed (809 ha) and summer barley (809 ha). Pulses such as linseed, chickpeas and lentils are also an important part in the rotation and grown on 2,730 ha. Due to the short, dry growing season just 55 kg/ha of nitrogen are applied for wheat which yields 2.4 t/ha. Also here the risk of nitrogen leaching is lower than on the EU-farms.

UA2600WU is located in the north of the Ternopil region. This is the area with fertile Chernosem soil. This region has a moderate continental climate with cold, snowy winters and warm summers. Snow cover usually lasts from November until March. The average annual precipitation is 600 mm. June and July are the wettest months and January and February are the driest. As snow cover is usually quite good, winter crops prevail in this region. Because of a rather wet May-July period, farms usually apply more fungicides and sometimes face problems with wet harvests. The typical farm of 2,560 ha of arable land is owned by a holding company which rented the entire land area. The average field size is 60 ha. A minimum tillage system is implemented on this farm. The main crops are winter wheat (760 ha), soybeans (600 ha) and rapeseed (590 ha). For a winter wheat yield of 3.4 t/ha, 90 kg nitrogen are spread. The weather conditions and low nitrogen input result in a lower risk of nitrogen leaching than on the EU farms.

UA1500SU: is located in the central plains of the Crimean peninsula. This part of Crimea is situated in a moderate continental climate zone with low precipitation - 300 mm per annum with more rains during June-August. The prevailing soils are southern chernozems which are a bit less fertile than typical chernozems. The temperatures in July reach almost 30°C. Dry conditions, especially in spring, necessitate a high share of winter crops (wheat) and some sunflowers in the crop rotations. Yields are very dependent on levels of precipitation. Due to the specific climate

conditions, wheat in this region has high protein content. The farms in this region use very little plant protection and usually do not have problems with fungi. The typical farm with 1,500 ha of arable land is owned by a holding company. The crop portfolio consists of winter wheat (700 ha), winter barley (500 ha) and sunflower (300 ha). The yield levels are 2 t/ha for wheat, 1.9 t/ha for barley and 1.1 t/ha for sunflowers. Only wheat and barley are fertilized with 34 kg of nitrogen. Sunflowers are not fertilized at all. Also here the risk of nitrogen leaching is lower than on the EU farms.

Table 4.54 – Typical farms: key variables of the arable farms (2010)

	unit	DK700 FYN	DK1200 SL	DE120 HI	DE1100 MVP	HU1100 TC	UK400 SUFF	CA1700 SAS	CA6000 SAS	UA2600 WU	UA1500 SU
Region		Funen	Lolland	Hildesheim	Mecklenburg	Tolna County	Suffolk	Black Soil Zone	Brown Soil Zone	Rivne	Crimea
Arable land	ha	675	1,230	120	1,080	1,100	400	1,718	6,075	2,556	1,500
Owned land	%	80	100	50	8	0	92	65	25	0	0
Rented land	%	20	0	50	92	100	8	35	75	100	100
Land rents (old contracts)	€/ha	600	470	475	190	140	175	70	55	19	29
Land rents (new contracts)	€/ha	540	600	600	350	170	200	70	60	29	37
Average temperature	°C	8.10	8.10	9.20	8.50	10.50	9.60	2.20	3.50	7.70	10.60
Average precipitation	mm/year	639	584	708	670	550	650	400	400	600	350
Soil type		easy clayey	easy clayey	black soil (loess)	sandy loam loamy sand	brown forest soil	chald/clay	black soil	brown soil	chernozem	south chernozem
Relief		n.a.	n.a.	gentle hills	plains	plains	n.a.	prairies	prairies	gently hills	plains
Elevation	m	20	20	100	-	150	100	500	500	270	50
Average field size	ha	20	20	3	25	45	15	100	320	60	80
Tillage system		conventional	conventional	conservatory	conservatory	conventional	no- till	no- till	no till	conservatory	conservatory
Legal form*		BF	BF	FF	CCOP	COOP	BF	FF	FF	BF	BF
Family labour	h/year	-	-	1,700	-	-	1,300	1,000	2,700	-	-
Employees	h/year	5,300	6,900	100	16,000	21,000	4,400	2,100	3,300	150,000	41,800

**Legal form: FF = family farm; BF = business farm; FFP = family farm partnership; CF = Cooperative*

Table 4.55 – Typical arable farm: production system in EU Member States

		unit	DK700 FYN	DK1200 SL	DE120 HI	DE1100 MVP	HU1100 TC	UK400 SUFF	CA1700 SAS	CA6000 SAS	UA2600 WU	UA1500 SU
yield	sugar beets[1]	ton/ha		11.90	14.30	8.90						
	wheat	ton/ha	8.00	8.10	9.30	8.10	4.90	8.90	2.80	2.40	3.40	2.00
	barley	ton/ha	6.60	7.60		7.30	4.80		3.70	2.40	1.90	1.90
	malting barley	ton/ha	6.30	6.10								
	corn	ton/ha					8.60					
	corn for silage[2]	ton/ha			55.50	32.40						
	rapeseed	ton/ha	3.60	4.50	4.30	4.30	2.70	3.40	2.30	1.60	2.60	
	soybean										1.60	
	sunflower											1.10
	pulses	ton/ha		5.70				3.80	2.50	1.80		
	grass seeds	ton/ha	1.30	1.60								
	other	ton/ha	1.40	5.40		6.00	3.10		3.90	2.50		
N-Input	sugar beets	kg/ha		111	202	154						
	wheat	kg/ha	149	166	194	233	137	192	61	55	87[3]	34
	barley	kg/ha	185	150		130	108		40	54	51	34
	malting barley	kg/ha	92	108								
	corn	kg/ha					200					
	corn for silage	kg/ha			200	221						
	rapeseed	kg/ha	146	180	272	117	159	192	37	45	139	
	soybean										34	0
	sunflower											
	pulses	kg/ha		10				-	35	14		
	grass seeds	kg/ha	163	132								
	other	kg/ha	96	173		168	92		61	48		

[1] *The yield for sugar beets is expressed in t of sugar per hectare.*

[2] *The yield of corn for silage is expressed in ton of fresh matter per hectare; the dry matter content is 33 %.*

[3] *For the UA_2,600 farm, the yield and nitrogen input of wheat are given as the average for winter wheat and summer wheat.*

Table 4.56 – Typical arable farms: land use in EU Member States

	unit	DK700FYN	DK1200SL	DE120HI	DE1100MVP	HU1100TC	UK400SUFF
sugar beets	ha		271	25	22		
wheat[1]	ha	153	372	72	475	330	224
barley	ha	49	106		86	110	
malting barley	ha	191	185				
corn	ha					440	
corn for silage	ha			11	173		
rapeseed	ha	79	81	12	292	110	88
pulses	ha		45				88
grass seeds	ha	171	94				
other	ha	32	76		32	110	

[1] *All the EU farms produce winter wheat.*

Table 4.57 – Typical arable farm: land use in Third Countries

	unit	CA1700SAS	CA6000SAS	UA2600WU	UA1500SU
wheat[2]	ha	344	809	1,166	700
durum	ha		1,009		
barley	ha	343	809	200	500
oats	ha	215	10		
rapeseed	ha	343	809	590	
soybean	ha			600	
sunflower	ha				300
other pulses	ha	258	2,323		
linseed	ha	215	405		

[2] *Canadian farms produce only summer wheat; UA_1500 farm produces only winter wheat; UA_2,600 farm produces 65 % of winter wheat and 35 % of summer wheat*

4.6.4. Cost of production

The aim of Table 4.58 and Figure 4.30 presented here is to offer an overview of the total cost of production as well as the cost structure for the typical farms analysed. The cost items defined for the analysis (land cost, labour cost, capital cost and non-factor costs) are shown as stacked bars, whose summed height represents the total cost level. Wheat revenues are depicted as well, in the shape of a line.

Note that the aim of this section is to compare the typical farms on the basis of the *base scenario*, therefore showing only the figures referring to the legislative situation in 2010. The comparative analysis of production costs results from the chart and the table provided below. The latter gives the absolute values, separated according to the cost factors defined (land, labour, capital, non-factor costs), and reveals the specific differences for each across the countries. The graphic representation

adds clarity to the analysis by visualising the peculiarities of each typical farm. In Table 4.59, the main drivers which explain differences in the production costs are described.

The Danish farms bear the highest costs for wheat producers of the farms considered: total production costs range between 250 €/ton and 270 €/t. The lowest producer costs (103 €/t) are on the South Ukrainian farms. Therefore the difference between the highest and lowest producer costs within this sample is about 170 €/t. When interpreting the results of production costs, it is important to keep in mind that the cost calculations are based on 2010 yields and do not represent average yield levels. Therefore a yield variation can heavily affect the production cost on a per tonne basis. As shown in Table 4.59, the Danish farms had about 15 % lower yields in 2010 compared to the three- year average from 2008 to 2010. If average yield levels are assumed for the Danish farms, their production costs decrease to 220 €/t but still remain the highest. On the other farms, the yield effect of 2010 is negligible as the farms almost achieved average yield levels.

The South Ukrainian and the large Canadian farm have the lowest production costs of just 103 €/t and 145 €/t respectively. The production costs are slightly higher (150 €/t) on the Hungarian farm. Except for the large German farm, the production costs of the western European farms are generally above 170 €/t.

To understand the cost differences between the countries, a closer look at the different cost items is necessary. The impact of capital costs on total production costs is generally minimal for both the typical EU and Third Country farms studied.

Inter country labour costs are highly variable, representing a considerable portion of total costs for Denmark while, on the other hand, are negligible for Canada. As Table 4.59 shows, differences in labour costs can only partly be explained by differences in wage rates: The Canadian farms face the second highest wage rates (Table 4.59). Therefore, the low labour costs of the Canadian farms are caused by higher labour productivity. While the European farms achieve a labour productivity of 0.5 t/h, the Canadian farmers harvest 1.6 t wheat per hour of labour. The Ukrainian farms have the lowest labour productivity. However, due to low wage rates it does not result in higher labour costs.

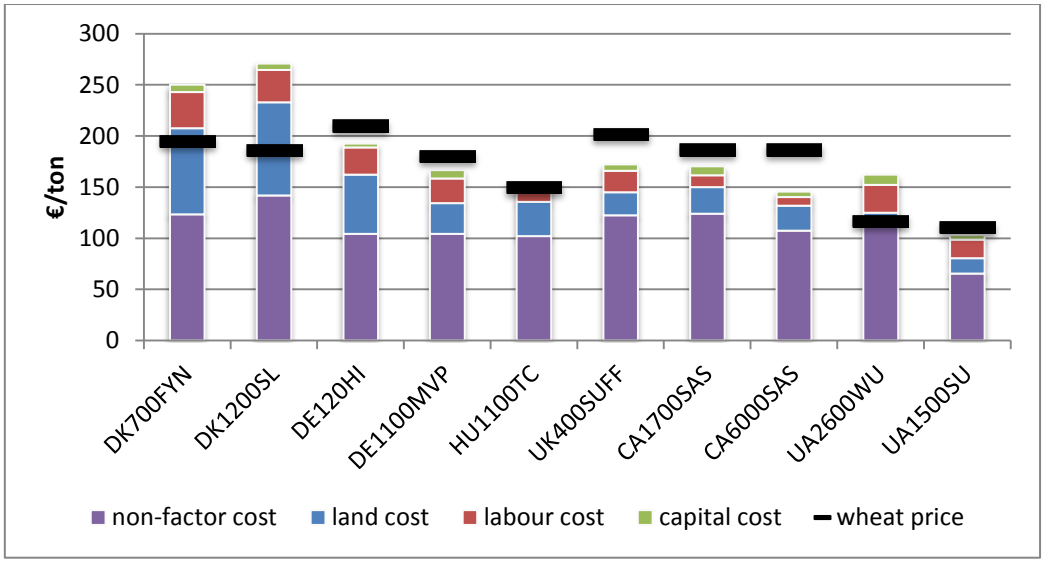
Land costs also differ considerably between countries. The Danish and the small German farms have the highest land costs of 60 to 90 €/t. In comparison, the land costs of the Ukrainian and Canadian farms are in the range of only 10 to 25 €/t. Therefore the difference in land costs between the EU and Third Country farms range from 35€/t up to 80 €/t. It can be assumed that the high land costs within the EU are influenced by decoupled payments which are at least partly passed on to the landlords. Table 4.59 illustrates the land costs and the direct payments per hectare. If direct payments are deducted from land costs, the difference in land costs between the EU and Third Country farms decreases to less than 35 €/t. Some EU farms even show negative net land cost

which means that their decoupled payments are exceeding their current land costs. Even after subtracting the decoupled payments, the Danish farms show the highest net land cost of 40 to 45 €/t. This indicates a very high level of competition for Danish land that is mainly driven by the livestock farms demand for land..

The non-factor costs represent the highest cost item for all farms. Only the UA1500SU farm has exceptionally low non-factor costs of just 65 €/t. They can be explained by the farm's low input system. As Table 4.59 shows, the nitrogen input is the lowest within the sample. Among the other farms, the differences in non-factor costs are a lot smaller than in land costs. Most of the farms have non-factor costs in the range of 100 to 120 €/t. A closer look at the non-factor costs shows that the EU farms have lower direct costs than their Canadian colleagues. On the other hand the machinery costs are much lower on the Canadian farms (see Table 4.59). The low machinery cost and the high labour productivity of the Canadian farms indicate a leaner organisation.

The revenues realized by the west European and Canadian farms are in the range of 180 to 210 €/t. The eastern European farms only realized wheat revenues of 110 to 150 €/t. The Ukrainian farms get lower wheat prices as Ukraine is a net exporter of wheat and therefore higher transport costs lower the farm-gate wheat prices. Additionally the Ukrainian parliament set export quotas in 2010. Wheat production on the German, UK and Canadian farms was profitable as revenue covered total production costs. Due to high land costs, the Danish farms were not able to cover their entire production costs. The low revenues on the western Ukrainian farm hardly covered non-factor costs.

Figure 4.30 – Wheat production costs in selected countries, 2010



Own calculation

Table 4.58 – Wheat production costs in selected countries, 2010

	unit	DK700 FYN	DK1200 SL	DE120 HI	DE1100M VP	HU1100T C	UK400 SUFF	CA1700 SAS	CA6000 SAS	UA2600W U	UA1500 SU
land cost	€/ton	84.3	91.1	57.9	30	33.2	22.5	26	24.3	10.3	15.2
labour cost	€/ton	35.4	31.6	26.5	24.1	10	20.8	11.5	8.5	27.1	18
capital cost	€/ton	7.1	6.4	3.8	8	6.7	6.5	8.9	5.5	10.1	4.6
non-factor cost	€/ton	123.3	141.8	104.3	104.4	102.2	122.5	123.9	107.4	114.6	65.3
total cost	€/ton	250.1	270.9	192.5	166.5	152.1	172.3	170.3	145.7	162.1	103.1
wheat price	€/ton	194.7	186	210	180	149.7	201.8	186.3	186.3	116.9	110.6

Own calculation

Table 4.59 – Production cost drivers for wheat

cost item	unit	DK700 FYN	DK1200 SL	DE120 HI	DE1100M VP	HU1100 TC	UK400 SUFF	CA1700 SAS	CA6000 SAS	UA2600W U	UA1500 SU
yield 2010 vs. average	%	-13	-16	1	-3	-5	-1	0	-2	-3	5
labour productivity	t/h	0.80	1.10	0.60	0.40	0.20	0.50	1.60	2.20	0.10	0.05
labour costs	€/h	27.30	34.20	15.60	9.60	2.50	10.70	18.80	19.00	1.30	1.50
Land cost	€/ha	583	618	544	235	153	197	73	57	34	32
direct payments	€/ha	290	309	362	351	166	287				
N-Input	kg/t	26	24	21	30	29	22	22	24	32	16
Direct cost	€/t	57	66	40	52	63	58	87	73	50	30
Machinery cost[1]	€/t	43	60	43	49	31	49	39	29	58	37

[1] *including diesel and contractors*

Own elaboration

4.6.5. Selected legislation

In total, 12 directives and regulations were selected and clustered into the groups of the environment and food safety. The cluster "environmental legislation" (ENV) considers the Nitrate Directive, the Directive on plant protection products, the Directive on the sustainable use of pesticides, and GAECs 1 to 5. The cluster "Food safety legislation" (FS) covers aspects connected to the requirements set by the Regulation (EC) 178/2002, the Regulation (EC) 852/2004, and the Regulation (EC) 396/2005.

The following section analyses how the regulations are implemented in the countries considered and in which fields cost saving could be realized if the regulations were not in place.

4.6.5.1. Legislation requirements

To quantify the cost of compliance we must know the consequences of the regulations on practical farming. Therefore Table 4.60 gives an overview of the requirements for farming which are used to implement the legislations in the different countries. The Third Countries are also included in the table so as to be able to identify differences between EU and Third Countries. For the Third Countries, the explicit references to their peculiar body of laws are missing.

Table 4.60 – Specific normative requirements of selected legislation for wheat production

code	legislation	DK	DE	HU	UK	CA	UA
ENV	**Nitrate Directive (91/676/EEC)**						
	o Nitrate Vulnerable Zones (NVZ)	o	o	x	x	o	o
	o ban on use of chemical fertiliser/manure in autumn and winter	x	x	x	x	x	x
	o ban on N on water-logged or frozen ground	x	x	x	x	o	o
	o buffer strips to water courses inside NVZ	x	x	x	x	o	o
	o establish fertiliser planning	x	x	x	x	o	o
	o establish farm-based nutrient balance	x	x	x	x	o	o
	o soil sampling		o	o			
	o min area covered with catch crops	x	o	o	o	o	o
	o min capacity for manure storage	x	x	x	x	o	o
	o max level of N from manure (kg/ha/year)	140[1]	170	170	170	o	o
	o max level of fertiliser for each crop	x	o	x	x[2]	o	o
	o special spreading conditions	x	x	x	X	o	o
	o special storage vessels for manure	x	x	x	x	o	o
	o special equipment to avoid leakage/structural defects	x	x	x	x	o	o
	o record application of fertiliser	x	x	x	x	o	o
	o conditions for transport of excess manure	x	x	x	x	o	o
	Regulation on Plant protection products (1107/2009/EEC) and						

code	legislation	DK	DE	HU	UK	CA	UA
	Directive on Sustainable use of pesticides (2009/128/EC)						
	o register of approved plant protection products	x	x	x	x	x	x
	o approval of pesticides limited to certain crops	x	x	x	x	x	x
	o pesticide guidelines	x	x	x	x	x	x
	o apprenticeship/training to use pesticides	x	x	x	x	o	o
	o obligatory sprayer inspections	x	x	x	x	o	o
	o requirements on storage rooms for pesticides	x	x	x	x	o	x
	o buffer strips to water courses	x	x	x	x	x	x
	o outside cleaning of sprayer only on-field, or special washing places	x	x	x	x	o	o
	o obligatory inside cleaning of sprayer on-field	x	x	x	x	o	o
	o precautions for disposal of empty pesticide containers	x	x	x	x	x	o
	o keep records of plant protection measures	x	x	x	x	o	x
	Minimum soil cover, land management and crop rotation (GAEC 1, 1a and 3)						
	o tillage restrictions (season, erosion zones)	x	x	x	x	o	o
	o min level of crop rotations	o	x	o	o	o	x
	o requirements on humus balance	o	x	x	o	o	o
	o requirements on plant cover, fallow land and mowing	x	x	x	x	o	o
	o ban on stubble burning	x	x	x	x	o	o
	o time limit between seed bed preparation and seeding	o	o	o	x	o	o
	o time limit to repair damage of access to waterlogged soils	o	o	o	x	o	o
	Establishment of buffer strips in the UK and DK (GAEC 2)						
	o ban on fertiliser on buffer strips next to water courses	x	o	o	x	o	x
	o ban on pesticides on buffer strips next to water courses	x	o	o	x	x	x
	o ban on tillage on buffer strips next to water courses	x	o	o	x	o	x
	Avoiding encroachment of unwanted vegetation (GAEC 4)						
	o seed down to grass unused land	x	x	x	x	o	o
	o regular mulching of unused land	x	x	x	x	o	o
	Retention of landscape features (GAEC 5)						
	o ban on removing landscape features	o	x	x	x	o	o
FS6	**Regulation on General principles of food law (178/2002), Regulation on Hygiene of foodstuffs (852/2004), and Regulation on Maximum residue levels of pesticides in or on food and feed (396/2005)**						
	o keep records of input products and suppliers	x	x	x	x	o	o
	o keep records of products sales	x	x	x	x	o	o
	o keep records of foodstuff inspections	x	x	x	x	o	x
	o separate food storage from pesticides, diesel, oil	x	x	x	x	o	o
	o obligatory foodstuff inspections if contamination is suspected	x	x	x	x	o	x
	o recall of foodstuff in case of contamination	x	x	x	x	o	o

code	legislation	DK	DE	HU	UK	CA	UA
	o ban on pesticide residues in grain	x	x	x	x	x	x
	o maximum DON level	x	x	x	x	x	x

Symbols: x = enforced in the country; o = no specific legislation

[1] *140 kg for pig and poultry manure; 170 kg for cattle, sheep and goat*

[2] *Winter wheat 220 kg N/ha standard yield 8 t/ha; Spring wheat 180 kg N/ha standard yield 7 t/ha; Winter OSR 250 kg N/ha standard yield 3.5 t/ha; Winter Barley 180 kg N/ha standard yield 6.5 t/ha; Spring Barley 150 kg N/kg*

A. ENVIRONMENT

The **Nitrate Directive (91/676/EEC)** applies to all EU Member States, and acts to prevent the contamination of the environment. No comparable regulation exists in the selected Third Countries, while Canada only provides a set of recommendations on the amount and timing of nitrogen applications. The Directive aims at protecting ground and surface water from pollution caused by nitrates deriving from agricultural sources. It also encourages the adoption of good farming practices. Its implementation takes place through the establishment of Nitrate Vulnerable Zones (NVZs). If a territory is classified as an NVZ, the producer must comply with an NVZ Action Programme, which includes a number of measures.

- There is a general ban on the application of chemical fertilisers or manure during autumn and winter. Organic manure or N fertilisers cannot be applied where the ground is waterlogged, flooded, frozen hard or covered with snow.
- Slurry storage facilities with sufficient capacity must be available to cater for the closed period, or alternative arrangements should be made.
- Crop requirement limits must be respected by not applying more N than a crop requires, taking into account elements like crop uptake, soil N supply, excess winter rainfall, and plant or crop available N from organic manures.
- N fertilisers and organic manure should be spread as evenly and accurately as possible. Furthermore, they cannot be applied to steeply sloping fields and in a way that contaminates watercourses. Organic manures cannot be applied within 10 m of watercourses.
- Any material or fertiliser that contains N and is applied to the land must be considered in the N fertiliser calculations. Producers must keep farm and field records on cropping, livestock numbers, N fertiliser usage and manure usage, for a minimum of five years after the relevant activity takes place.

The directive has been implemented differently among the Member States. In Hungary and in the United Kingdom, nitrate vulnerable zones (NVZ) were established where a farmer must comply

with the nitrate action programme, whereas in Germany and Denmark the action programme applies to the whole country. On the other hand, good agricultural practices and cross compliance measures are compulsory for the entire country.

The **Directive on plant protection products** regulates the trade and use of plant protection substances and active ingredients within the EU. The norm also describes the procedure necessary to achieve authorization for new pesticides, and how these products can be placed on the market.
At the farm level, specific requirements exist that affect production: (1) farmers can only use plant protection products authorized for sale under current legislation; and (2) farmers must follow the usage specifications provided by the manufacturers. Both said specifications also apply to the Third Countries considered.

The **Directive on the sustainable use of pesticides** aims at establishing closer monitoring and training for pesticide application in the Union. Consequences for farmers include:

- attending a training course and being granted a certificate in order to use the product;
- record-keeping of pesticide applications;
- compliance with a number of detailed requirements for storage facilities;
- inspection of sprayers;
- cleaning the sprayer(s) exclusively on field or at special washing facilities.

In Denmark the pesticide tax has also been considered because the aim of the study is to analyse the cost of compliance in different member states after the implementation of the EU regulations. In particular, Article 4 of Directive 2009/128/EC says: “Economic instruments can play a crucial role in the achievement of objectives relating to the sustainable use of pesticides. The use of such instruments at the appropriate level should therefore be encouraged while stressing that individual Member States can decide on their use without prejudice to the applicability of the State aid rules” Thus, the pesticide tax in Denmark is linked to the EU regulation even if it goes beyond what is needed to fulfil the EU requirements.

Outside the EU, most of these issues are not relevant at farm level as they are not addressed by national law. Ukraine only established the requirements for storage facilities for pesticides and the documentation of pesticide applications. Additionally, the daily working time for employees with pesticides is limited to 6 hours/day.

Within the **Good Agricultural and Environmental Conditions (GAECs)** defined in the framework of cross compliance, soil issues and minimum maintenance level of land are important components. Because of GAECs soil protection claims, EU-farmers are not allowed to burn stubble on-field and are required to comply with tillage restrictions in areas subject to soil erosion.

Additionally, in some EU Member States standards for crop rotations and humus balances are prescribed. However, as they are mostly not addressed in Third Countries legislations, these issues do not apply here.

In 2010, GAEC 2 was only implemented in the United Kingdom. Other EU Member States require farmers to keep buffer strips for nitrogen (Nitrate Directive) and for pesticides (Directive on the sustainable use of pesticides) if the farm is located in an NVZ. In Third Countries, buffer strips are considered in the national regulations as well, though in some cases, like Canada, they only apply to pesticides.

Due to GAEC 4 on avoiding the encroachment of unwanted vegetation, farmers in the EU have to mulch used arable land either every year or every second year. Such a condition does not apply to Third Country farmers, where mulching of unused land is not regulated.

The retention of landscape features (GAEC 5) is implemented in most of the European Union with the exception of Denmark, where the removal of landscape features is not forbidden and only ancient monuments like burial mounds and barrows are protected. On the contrary, farmers located in the Third Countries studied are allowed to remove landscape features.

B. FOOD SAFETY

The food safety regulations selected for the wheat industry within the EU (Regulation (EC) 178/2002, Regulation (EC) 852/2004, and Regulation (EC) 396/2005) are more detailed compared to non EU-countries. Basic requirements, such as those concerning residue levels of pesticides or maximum levels of mycotoxins, are compulsory for all Member States. Traceability and storage of foodstuffs are strictly regulated; however it can be reckoned that they are likely to have a low impact on production costs. The rationale is that traceability requirements are already fulfilled by delivery orders and invoices which are needed for accounting purposes.

C. NEW MEMBER STATE: HUNGARY

Given its status as new Member State, after joining the Union in 2004, the adoption and implementation of EU directives and regulations in Hungary followed the timetable detailed in the table below.

Table 4.61 – Timetable of the implementation of selected EU directives in Hungary

Stage	Area	Legislation	Requirement
form April 2001	Environment	Directive 91/676/EEC on the protection of water against pollution caused by nitrates from agricultural sources	SMR 4
form July 2004	Environment	Directive 91/676/EEC on the protection of water against pollution caused by nitrates from agricultural sources	SMR 4
form April 2008	Environment	Directive 91/676/EEC on the protection of water against pollution caused by nitrates from agricultural sources	SMR 4
from July 2011	Environment	Directive 1107/2009/EEC regulating the trade and use of plant protection products and active ingredients in the EU	SMR 4
from April 2008	Environment	GAEC 1 establishing a minimum soil cover	SMR 4
from April 2008	Environment	GAEC 1a on land management practices	SMR 4
from April 2008	Environment	GAEC 3 on crop rotation practices	SMR 4
from April 2008	Environment	GAEC 4 on techniques for avoiding encroachment of unwanted vegetation	SMR 4
from November 2010	Environment	GAEC 5 on the retention of landscape features	SMR 4
from June 2008	Food safety	Regulation 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority, and laying down the procedures in matters of food safety	SMR 11
from June 2008	Food safety	Regulation 852/2004 on the hygiene of foodstuffs	SMR 11
from June 2008	Food safety	Regulation 396/2005on maximum residue levels of pesticides in or on food and feed of plant and animal origin, amending Council Directive 91/414/EEC	SMR 11

4.6.5.2. Cost items list and potential impact at farm level

In the following table, items of potential cost savings at farm level are listed which could be generated if the different legislative measures were not in place. The list is based on the information collected in the focus group discussions in each of the countries. Crosses indicate which measures would result in cost savings if they were abolished.

Table 4.62 – Comparison of legislative areas impacting cost of compliance in wheat production

legislation		item	DK	DE	HU	UK	CA	UA
ENV	Nitrate Directive	pesticide storage	x	x	x		x	
		record keeping for nitrogen application	x	x	x	x		
		limitation of N-input below the	x					

	economic optimum						
Plant protection products	washing equipment for sprayer	x	x	x	x		
	technical control of sprayer	x	x				
	record keeping for pesticide application	x	x	x	x	x	
	application of pesticides	x	x	x	x		
	training for workers applying pesticides		x		x		
	disposal of pesticide containers		x				x
GAEC 2	buffer strips	x	x	x	x	x	
	obligatory catch crops	x					
	burning restrictions on straw		x				
Food Safety	documentation for food safety	x	x	x	x	x	

Symbols: x = identified as compliance cost

In Denmark, Germany and the UK, an abolition of most of the listed measures would lead to cost savings. The following cost savings would only occur in one country:

- Due to the pressure caused by black grass, the farmers of the UK focus group argued that they would expect cost savings if they were allowed to burn straw again.
- Only the participating Danish farmers expected some cost savings (additional revenue) if they were allowed to use the economically optimal nitrogen input.
- Additionally, only in Denmark did the farmers expect costs savings if they did not have to plant catch crops on 10% to 14% of their land.
- As a pesticide tax exists only in Denmark, among the analysed typical farms, the Danish farmers alone would benefit if this tax were abolished.

Compared to the EU Member States, there are very few potential cost savings for the Third Countries in the 'without' situation.

4.6.6. Cost of compliance with selected legislation

The aim of the section is to analyse the cost of compliance with the legislation clustered as "environment" and "food safety" for the typical farms studied. In this section, only the results are shown. For the comparative analysis of production costs, forgone revenues were considered as negative costs in the "without legislation" scenario.

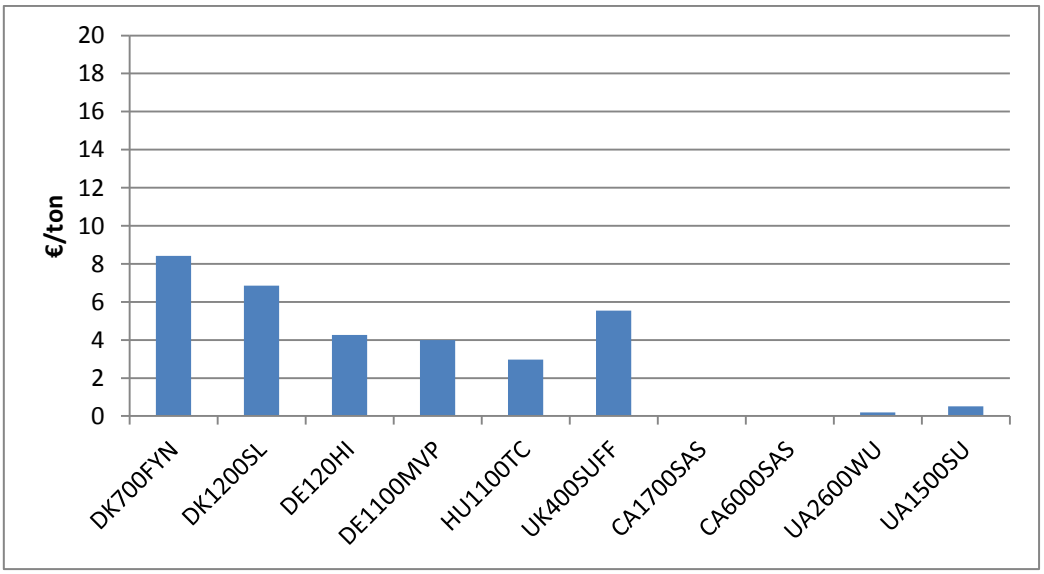
In Table 4.63 and Table 4.63 the differences in cost of production between the base scenario and the 'without' legislation scenario are shown. In the former, only the abolition of environmental regulations while in the latter, only the abolition of food safety regulations are considered. Besides the absolute difference in production cost, the relative change with respect to the base situation is also displayed. Figure 4.32 and Figure 4.32 show the differences as cost of compliance.

Table 4.63 – Cost of compliance with environment legislation for wheat in selected countries

environment		unit	base	without	difference	% change
Denmark	DK700FYN	€/t	250.07	241.48	8.59	3.42
	DK1200SL	€/t	270.96	264.01	6.95	2.57
Germany	DE120HI	€/t	192.47	188.20	4.27	2.22
	DE1100MVP	€/t	166.59	162.60	3.99	2.40
Hungary	HU1100TC	€/t	152.06	149.10	2.96	1.97
United Kingdom	UK400SUFF	€/t	172.34	166.80	5.54	3.21
Canada	CA1700SAS	€/t	170.34	170.30	0.04	0.03
	CA6000SAS	€/t	145.71	145.70	0.01	0.01
Ukraine	UA2600WU	€/t	162.10	161.90	0.20	0.12
	UA1500SU	€/t	103.01	102.50	0.51	0.50

Own calculation

Figure 4.31 – Cost of compliance with environment legislation for wheat in selected countries



Own calculation

The absence of the selected environmental legislation would cause a decrease in total costs for the typical farms. Within the EU, the highest absolute impact is observed for the Danish farms (6.9 €/t to 8.4 €/t)[26], followed by the typical UK farm with 5.5 €/t. On the typical German farms, the cost saving ranges from 4, 0 €/t to 4.3 €/t. Within the EU Member States considered, the lowest cost impact is observed for the Hungarian farm. Conversely, the typical farms of the Third Countries considered, register just a small decrease in total costs when they do not have to comply with environmental regulations.

The level of compliance costs for environmental regulations is therefore higher on the EU farms than on the Third Country farms. The spread between the maximum value of the small Danish and the minimum value for the large Canadian farm is 8.4 €/t. The high cost level of the typical Danish farms is mainly caused by the national nitrogen standards, which limit the nitrogen application rate below the economic optimum. Cost levels are also influenced by the pesticide taxes.

Compared to the environmental regulations, the "without legislation scenario" for food safety regulation has a minor impact. The cost savings of the typical farms in wheat production are very limited and range from 0 €/ton to 0.6 €/ton. Within the EU-countries considered, the small German farm shows the highest compliance cost for food safety regulations (0.22 €/t). These costs are mainly caused by labour time for the documentation. The typical Canadian farms do not expect any cost reduction. On the typical Ukrainian farms, the cost impact of food safety regulations is a little higher than for the environmental regulations. Anyhow, the absolute cost impact is far below 1 €/t on the Ukrainian farm as well.

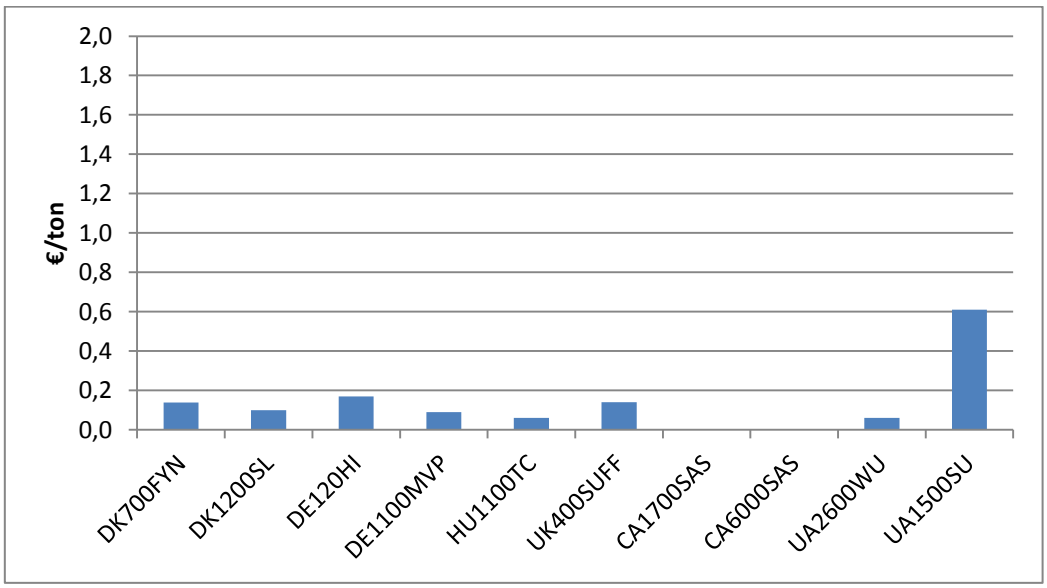
[26] The pesticide tax in Denmark is linked to article 4 of EU Directive 2009/128/EC. It is a stricter national implementation not required to fulfil the directive. To be more precise and to give an indication, it is possible to disaggregate this measure. In the absence of the pesticide tax, the compliance costs of the Danish farms would be reduced to 3.05 €/t (1200SL) and 4.66 €/t (700 FYN).

Table 4.64 – Cost of compliance with food safety legislation for wheat in selected countries

food safety		unit	base	without	difference	% change
Denmark	DK700FYN	€/t	250.07	249.93	0.14	0.06
	DK1200SL	€/t	270.96	270.86	0.10	0.04
Germany	DE120HI	€/t	192.47	192.30	0.17	0.11
	DE1100MVP	€/t	166.59	166.50	0.09	0.03
Hungary	HU1100TC	€/t	152.06	152.00	0.06	0.05
United Kingdom	UK400SUFF	€/t	172.34	172.20	0.14	0.07
Canada	CA1700SAS	€/t	170.34	170.34	0.00	0.00
	CA6000SAS	€/t	145.71	145.71	0.00	0.00
Ukraine	UA2600WU	€/t	162.10	162.04	0.06	0.37
	UA1500SU	€/t	103.01	102.40	0.61	0.58

Own calculation

Figure 4.32 – Cost of compliance with food safety legislation for wheat in selected countries



Own calculation

Table 4.65 and Figure 4.33 offer a more detailed view on the cost effects of important regulations. The environmental regulations are disaggregated into the Nitrate Directive, the Directive on plant protection products, the Directive on the sustainable use of pesticides, and the GAECs. Due to the low impact of food safety regulations, these values were not split up.

The typical Danish and UK farm would benefit most if the norms on the environment and food safety were abolished. On the other hand there would hardly be any effect for the Canadian farms. The total cost reductions range from 0.02% to 3.72%. Within the EU, the regulations on plant protection are the main drivers of the compliance costs. Without them, the production costs would decrease between 1.6% and 2.3%. Compared to the regulations on plant protection, the impact of

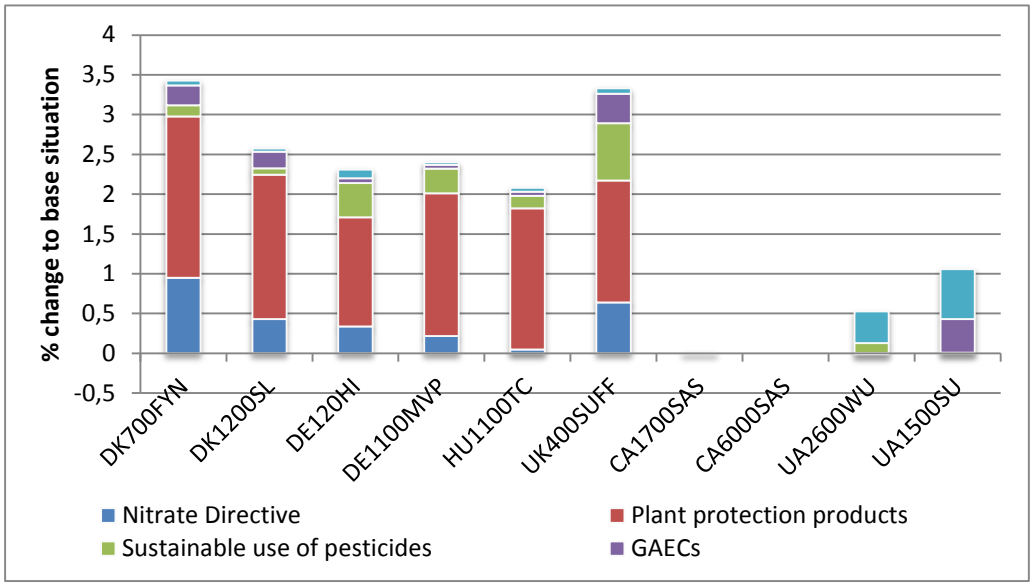
the Nitrate Directive is lower. The potential cost savings for wheat production without the Nitrate Directive range between 0.05% and 0.95% for the typical EU farms. The GAECs only have a significant impact in the United Kingdom. As mentioned before, the food safety regulations only cause a very limited cost of compliance.

Table 4.65 – Comparison of percentage change to base by normative area: wheat

	Nitrate Directive	Plant protection products	Sustainable use of pesticides	GAECs	Food safety	TOTAL
DK700FYN	0.95	2.03	0.14	0.25	0.06	3.43
DK1200SL	0.43	1.81	0.08	0.21	0.04	2.57
DE120HI	0.34	1.37	0.43	0.06	0.11	2.31
DE1100MVP	0.22	1.79	0.31	0.05	0.03	2.40
HU1100TC	0.05	1.77	0.16	0.05	0.05	2.08
UK400SUFF	0.64	1.53	0.72	0.37	0.07	3.33
CA1700SAS	0.00	0.00	0.02	0.00	0.00	0.02
CA6000SAS	0.00	0.00	0.00	0.00	0.00	0.00
UA2600WU	0.00	0.00	0.13	-0.01	0.40	0.52
UA1500SU	0.00	0.00	0.01	0.42	0.63	1.06

Own calculation

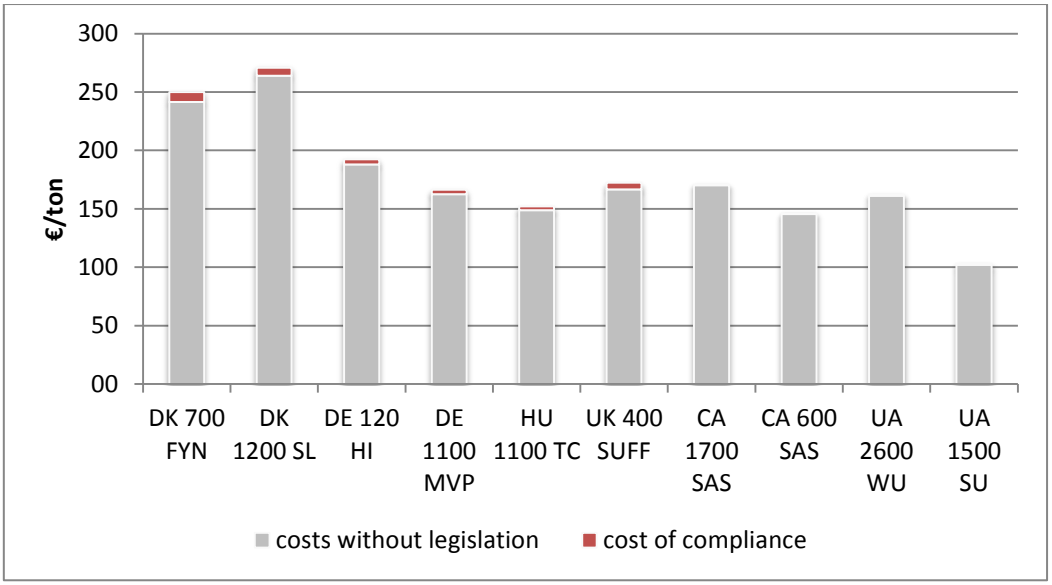
Figure 4.33 – Relative impact of selected regulations on production cost in % – wheat



Own calculation

As mentioned before, Figure 4.34 shows the production cost of the 'without' situation and the additional cost of compliance in the 'with' situation. It becomes clear that the production costs are only marginally increased by the compliance cost.

Figure 4.34 – Comparison of production and compliance costs for wheat, 2010



Own calculation

In general, the compliance costs of the analysed farms are relatively low and do not exceed 3.5 % of the total costs. This might be in contrast to the farmers' perception of high expenditures for food safety and environmental regulations in the year of investment. The reason for the low cost impact is that these investments are depreciated over 20 years and allocated to the whole arable land. Therefore the impact on a per ton basis is rather small. Another reason for the low compliance cost is that even without some of the regulations farmers would not change their management practices. They perceive them as good agricultural practices and see benefits of these practices.

The production costs per ton of wheat differ much more between farms than the compliance costs: The difference between the highest and lowest cost producer in the sample is higher than 150 €/t. The Danish farms have the highest production costs of 250 to 270 €/t and the Ukrainian farms the lowest with 103 to 160 €/t. Therefore, the compliance costs are not able to explain the differences in productions costs. The differences in production costs are mainly driven by The European farms have the highest land costs from 30 up to 90 €/t for wheat in the case of Denmark, whereas the land costs of the Ukrainian farms are limited to 10 to 15 €/t of wheat. Hence, the low land costs are a competitive advantage for the Ukrainian farms. Anyhow, one needs to keep in mind that the farm gate prices of the Ukrainian farms studied were also 70 to 100 €/t below the farm gate prices of the West European farms studied. The lower farm gate prices are mainly driven by higher transport and logistic costs. Therefore the Ukrainian farms have to produce at lower cost levels. It is also obvious that lower farm gate prices lead to lower returns on land and lower land costs. For the European

farms the high land costs are also influenced by decoupled payments which are at least partly passed on to the landlords. If direct payments are deducted the land costs of the European farms considered are reduced substantially.

The labour costs differ extensively between the Canadian and the West European farms considered. While the labour costs account 25 to 35 €/t on the West European farms, the Canadian farms considered have labour costs of just 8 to 12 €/t of wheat. These differences can only partly be explained by differences in wage rates. Wages on Canadian farms (19 €/h) are in the same range as on most of the West European farms. Therefore, the lower labour costs of the Canadian farms are a result of higher labour productivity. Canadian farmers produce up to 1.1 t more wheat than their West European colleagues per hour of labour input.

4.7. Case study: Apples

4.7.1. Choice of countries

In order to represent all the different aspects of the apple industry as representative of the European Union's fruit sector, two EU Member States with different characteristics were chosen. Two Third Countries were selected as well for comparison purposes. On the basis of the selection criteria described in section 1.3.3, the countries investigated for the fruit sector are: Germany, Italy, Chile, and South Africa.

The choice of apple producing countries reflects the importance in terms of production quantities and trade partners in Europe. The largest apple producer in Europe is Italy, supplying 2.2 million tons in 2010 – especially to Germany, which is the main export market. Germany itself ranks 4th in production volume in Europe with 834,960 tons of apples, which reflects a direct competition for the product in both countries. One of the major German apple-producing regions, the Lake Constance region, has climatic conditions similar to the Italian region of Trentino Alto Adige, and the farm structure is similar as well, with small owner-operated family farms. In contrast, the production region in northern Germany is characterized by a colder climate and larger farms, usually also owner-operated specialized family farms. Major differences between these regions are the choice of varieties, installations in the field such as hail nets, late frost mitigation irrigation, pests and diseases, and marketing structures.

Chile and South Africa are the major exporters on the world market in the southern hemisphere with a total annual production of 1.1 million tons and 874,000 tons, respectively.

4.7.2. National farm structure

Table 4.66 shows a selection of key information concerning the structure of the national apple sectors in the selected countries. Italy is Europe´s largest producer (FAOSTAT, 2012) and has about 58,000 ha of area planted to apples in 2010. Germany and Chile have a similar size of acreage with 31,738 ha and 35,598 ha, respectively. South Africa has the smallest apple production area in the group. Availability of statistical census data on apple production differs between the countries, therefore information was provided for the most recent year if 2010 data were not available. Note that in Germany's case, a census is performed every five years, hence 2007 data is presented. In Chile, the 2010 figures refer to a census carried out between 2009 and 2010, which for most items

represents the most recent, exact statistics. Finally, fruit industry statistics are the most reliable information available for South Africa.

Table 4.66 – General information on apple producing countries, 2010

	unit	DE[1]	IT	EU27	CL	ZA	World
Area harvested	ha	31,762	57,907	533,401	34,733	21,554	4,733,861
Apple area bearing	ha	25,289	54,468		29,737	19,428	
Apple area non-bearing	ha	6,473	3,439		4,996	2,126	
% area new (non-bearing)		20.4%	5.9%		14.4%	9.9%	
Number of trees	units	67,862,193	n.a.		31,407,956	24,754,408	
Apple production	ton	1,070,000	2,204,972	10,700,066	1,624,000	753,168	70,035,74
Ø yield per area bearing	ton/ha	42	40		55	39	
Total number of producers	unit	9,058	50,625		2,933	470	
Ø ha per producer	ha/producer	3.5	1.1		12	46	
Currency		EUR	EUR	EUR	CLP	ZAR	-
GNI per capita[27]	US$	38,410	31,390	-	17,360	10,350	-

[1] *2007 data*

Sources: Statistisches Bundesamt, EUROSTAT, FAOSTAT, ISTAT, Census (Italy); Natural resources information centre (CIREN), ODEPA (census conducted between 2009 and 2011); HORTGRO statistics

Apples are traditional crops and have a strong demand on both local and domestic markets in Europe, while in Chile and South Africa apple production is mainly export-oriented. This explains the large structural differences in the sector between the European and the Third Countries. Germany and Italy have a high number of producers and a rather small average farm size, while in Chile- and in particular South Africa- there are fewer farms, which are relatively larger than European ones and are often operated with hired administrators. Structural differences are associated with basic differences in the production systems. In Germany, tree density is rather high with an average of 2,100-2,250 trees/ha, whereas it reaches 1,100 trees/ha in South Africa and only 900 trees/ha in Chile. Such information is not available for Italy, yet it is likely that tree densities

[27] Gross National Income (GNI) per capita is based on purchasing power parity (PPP). The indicator is calculated converting gross national income to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.

are similar to German conditions. Moreover, Germany has the highest share of apple area in new plantations up to 4 years of age (about 20% of total area), compared with around 14% in Chile, 10% in South Africa and only 5% in Italy, which is related to the average utilization period of the orchards.

4.7.3. Description of typical farms

The analyses of compliance costs for the selected apple producers were conducted, adopting an approach that is based on a number of typical farms for each country. These are farm models, established following a standardized methodology (discussed in chapter 3) based on statistics, farm advisors' expertise and group discussions with panels of farmers.
In this study, three typical farms were analysed for Germany, and two each for Italy, South Africa and Chile. In the following a short description is given of the typical apple farms and their most important characteristics.

DE21 and **DE40**: These farms are located in the most important apple growing region in Germany, the Altes Land. The former is a medium sized farm with 21 ha of productive land, while the latter is a large farm with 40 ha devoted to apple production. Farm structures are similar, since they are both classified as family farms, and the work force includes family as well as permanently hired labour. A broad range of at least 6 different varieties is grown, some of which are specific to the regions, as is the case of Holsteiner Cox. Increasingly, varieties with their own marketing brands like Kanzi are grown, which reach relatively high, stable prices. The main varieties cultivated in the typical farms of the Altes Land are the internationally traded Jonagold and Braeburn. Elstar, which is one of the most popular varieties in Germany, and particularly well-suited for this production region is also grown. The average utilization period of the orchards is lower compared to Italy (on average 18 years), and irrigation systems for late frost mitigation are established for 70% to 75% of the apple area. A special characteristic of this growing region is that farmers usually have their own Controlled Atmosphere (CA)/Ultra Low Oxygen (ULO) storage capacities, and also perform the grading process on-farm. Nonetheless, 100% of the production is sold via marketing cooperatives.

DE15: The farm is located in the second most important German growing region, the Lake Constance region. It represents a medium sized farm with 15 ha of apple production. In the typical farm in the Lake Constance region, the dominant varieties are similar to Altes Land, with Elstar and Jonagold. However here the Royal Gala variety is also grown on an important share of the apple

area. Irrigation is rarely installed, since late frosts are usually not an issue. Instead, especially in the last decade, hail nets have been built on new plantations, which have been subsidized by the EU through the operational programs of the producer organizations. The Lake Constance farm has no storage facilities of its own, but delivers to the cooperative directly after harvest.

IT5: The farm is located in Emilia Romagna, which ranks 3rd in the country in terms of apple production volume and 2nd in terms of number of producers. The legal form is the family farm, and production relies mainly on family labour. The typical farm in Emilia Romagna has only 5 ha of apples and 5 ha of other fruits. The entire apple area is irrigated, and the most important varieties are the internationally popular Fuji, Pink Lady and Gala, as well as the rather new variety Modì. The average utilization period of an orchard is in line with the other producing regions (up to 25 years).The yield level is slightly lower, although this might be related to the differences in varieties.

IT2.5: The farm is located in Trentino Alto Adige, the major productive region of Italy. It represents a quite small production unit, with only 2.5 ha of apple orchards, though the size is still larger than the regional average of 2.2 ha (ISTAT, 2010). Information shows that orchards in Trentino are continuously renewed, and have an average utilization period of about 20 to 25 years. The main variety cultivated on this typical farm is Golden Delicious, followed by Red Delicious, Renetta and Gala in equal planting areas. Yields are relatively high and reach up to 68 t/ha for the Delicious varieties. The farm is nearly entirely managed by the owner family, and seasonal labour is hired only during harvest as a complement. The entire production is sold to the marketing cooperative since storage facilities are not available at the farm.

CL25: the farm is located in the region “El Maule”, near Curicó, and represents a medium farm of 25 ha of apple production. This production area accounts for about 60% of Chilean apples, predominantly for export to other Latin American countries, the USA or Europe. Although clearly export-oriented, a large share of the production system is still rather traditional. Hence the typical farm has an average tree density of less than 1,000 trees/ha. This means that the trees are rather large, and operations such as pruning and harvesting are carried out manually using ladders. Increasingly, higher tree densities are common in new plantations, although still much lower than in Europe. The typical farm grows three different varieties: the internationally traded Granny Smith, Fuji and Royal Gala. Labour use is therefore higher than in Europe with 1.4 ha to 1.9 ha per full-time labourer. Family labour is not common. The typical farm has a hired full-time administrator

since the owner usually has other businesses or jobs and gets involved in the apple farm only part-time as supervisor.

CL80: The farm is located in the region O'Higgins, near Rancagua, and represents a large farm with 80 ha of apple growing area. The region yields 20% of the apple production and it is the second in the country in terms of quantity supplied. Here, too, average tree density is still below 1000 trees / ha, but in new plantations, density increases up to 1667 trees / ha. Three internationally traded varieties are grown: Pink Lady, Granny Smith and Royal Gala. The typical farm in this region is managed by a hired administrator.

ZA80: the farm is situated in the EGVV (Elgin, Grabouw, Vyeboom, Villiersdorp) region, and represents a medium-sized holding with respect to the regional average, with 80 ha of apple orchards. Eight different varieties are cultivated on this farm, including: Granny Smith, Golden Delicious, Red Delicious, Royal Gala, Braeburn, Fuji, Pink Lady and Sundowner. Tree densities are still lower than in Europe. From planting to first full harvest, on average 6 years are needed, which is 2 years longer than in Germany. Labour use is high, with a high share of permanent labour living on the farm in staff houses. So far, there has been very little mechanization, and machines are mainly limited to pesticide application equipment, as well as transport during harvest.

ZA120: The farm is located in the Ceres region, and represents a medium-sized holding with respect to the regional average, with 120 ha of apple orchards. The Ceres region supplies about 27% of South African apple production with: Granny Smith, Golden Delicious, Red Delicious, Royal Gala, Braeburn, Fuji, and Pink Lady. The production system is similar to that in EGVV, with large trees and low densities, high use of labour and very little mechanization. Yields are similar to those in Chile with about 50 to 80 t / ha for orchards in full production.

The key indicators of the typical farms are described in Table 4.68 and Table 4.68. Production systems are relatively similar in Germany and Italy, with high tree density and small trees, grown as Spindel, and a focus on mechanization to save labour costs. In both countries, apple farmers have access to EU subsidies either as de-coupled, area-based subsidies or as specific support schemes. Moreover, in both countries and regions the typical farms are members of a marketing cooperative, thus they sell either 80% to 90% of the production or all quality fresh fruit via such channel. Only juice/processing quality fruits, which are an unavoidable by-product, are sold directly to the processing industry. The marketing cooperatives require farm certification. The Italian typical farms

are certified for Tesco (UK) or GlobalGap; while the German farms comply with GlobalGap and/or certified integrated production.

In Chile and South Africa, tree densities are lower and trees are much larger, although a transformation is seemingly ongoing towards higher plant densities which can be observed on the new plantations. There is much less mechanization as compared to Europe. Labour input is much higher in both countries, given lower average wages.

In both Third Countries, apple production is targeted for export, either to Europe, the USA, or to other countries on the African/South American continents. The farms either have contracts with export companies or are members of a cooperative, export-marketing company, which furnishes central grading and storage facilities. The participation in certification schemes such as GlobalGap, TESCO Nature or SEDEX is a basic requirement to access export markets, national food retailers and supermarkets.

Table 4.67 – Typical farms: production systems EU Member States

		unit	IT5	IT2.5	DE21	DE40	DE15
Total farm size		ha	10	2.5	21.5	40	15
orchard in full production		ha	4	2.3	14.32	27.38	12
orchard younger than 4 years		ha	1	0.2	5.68	12.62	3
other farm branch		ha	5	0	1.5	0	0
Average orchard utilization period		years	18 to 25	18 to 25	18	18	20
Average time to first full yield		years	3	4	4	4	4
Share of irrigated orchards		%	100	100	75	70	0
Yield level full production		tons/ha	40 to 60	57 to 68	35 to 45	36 to 45	33 to 45
Top 3 varieties on farm	Name		Fuji	Golden Delicious	Jonagold	Jonagold	Jonagold
	ha		2	1.4	7	14	5
	Name		Pink Lady, Gala	Red Delicious, Renetta	Elstar	Elstar	Elstar
	ha		each 1	0.3	6	12	3
	Name		Modì	Gala	Braeburn	Braeburn	Gala
	ha		1	0.3	2	5	2.5
Plant density		trees/ha	2,500	2,500	3,000	3,000	3,000
Distance between the rows		m	4 m	3.50	250	2.50	2.50
Canopy management / production system			Spindel	Spindel	Spindel	Spindel	Spindel
Legal form			family farm	family farm	family farm	family farm	family farm
Decoupled payment, EU subsidies		€/ha	no	no	76.23	76.23	-
Subsidies		per farm	400 €	900 €/ha environmental scheme	no	no	50% investment hail nets (new orchards)
Vertical market integration/ marketing channels			100% cooperative	100% cooperative	100% cooperative	100% cooperative	100% cooperative
On-farm storage and grading			No	No	CA/ULO storage	CA/ULO storage	no
Private quality certification scheme			Tesco Nurture	GlobalGap	GlobalGap, Integrated production	GlobalGap, Integrated production	GlobalGap

	unit	IT5	IT2.5	DE21	DE40	DE15
Family labour	hours/year	2,700	873	2,000	4,000	5,400
Hired labour	hours/year	510	-	2,000	900	0
Seasonal workers	hours/year	1,500 (harvest)	400	3,474	8,800	5,888
Use of own machinery		yes	yes	yes	yes	yes
Co-operative machine pool/ hired machinery use			yes	yes	no	yes
Contractors		for new orchard	for new orchard	for new orchard	for new orchard	no
Harvesting system		manual with platform wagon	manual	manual	manual	manual

Source: Agri-benchmark horticulture

Table 4.68 – Typical farms: production systems Third Countries

		unit	CL25	CL80	ZA80	ZA120
Total farm size		ha	25	80	90	144
orchard in full production		ha	25	64	76	96
orchard younger than 4 years		ha	-	16	4	24
other farm branch		ha				24
Average orchard utilization period		years	20-30	20	20	20-30
Average time to first full yield		years	5-6	5	6	5-6
Share of irrigated orchards		%	100	100	100	100
Yield level full production		tons/ha	62.75	45 to 80	55-80	50-80
Top 3 varieties on farm	Name		Royal Gala	Granny Smith	Golden Delicious	Red Delicious
	ha		16.5	32	20	22.8
	Name		Granny Smith	Gala	Granny Smith	Golden Delicious
	ha		4	19.2	16.8	21.1
	Name		Fuji	Pink Lady	Royal Gala	Pink Lady, Gala
	ha		4.5	12.8	11.2	14.4 each
Plant density		trees/ha	990	990 to 1,667 (new plantations)	1,667	1,707
Distance between the rows		m	4	4	4	4

	unit	CL25	CL80	ZA80	ZA120
Canopy management / production system		Traditional large canopies/Spindel	Spindel	Spindel	Traditional large canopies/Spindel
Legal form		Family farm (with hired administrator)	Business farm	Family farm	Family farm
Decoupled payment, EU subsidies	€/ha	no	No	no	no
Subsidies	per farm	no	No	no	no
Vertical market integration/ marketing channels		Contract with exporter, export cooperative	Contract with exporter, export cooperative	Contract with exporter, export cooperative	Contract with exporter, export cooperative
On-farm storage and grading		no	no	no	no
Private quality certification scheme		GlobalGap	GlobalGap/TESCO	Global Gap, SEDEX	Global Gap
Family labour	hours/year	1,000	0	2,052	2,160
Hired labour	hours/year	5,000	24,000	55,404	101,520
Seasonal workers	hours/year	20,000	88,803	59,450	136,080
Use of own machinery		Yes	Yes	Yes	Yes
Co-operative machine pool/ hired machinery use		Yes	No	No	No
Contractors		Yes	Yes	Yes	Yes
Harvest: manual or machine harvest		Manual with ladders	Manual with ladders	Manual with ladders	Manual with ladders

Source: Agri-benchmark horticulture

4.7.4. Cost of production

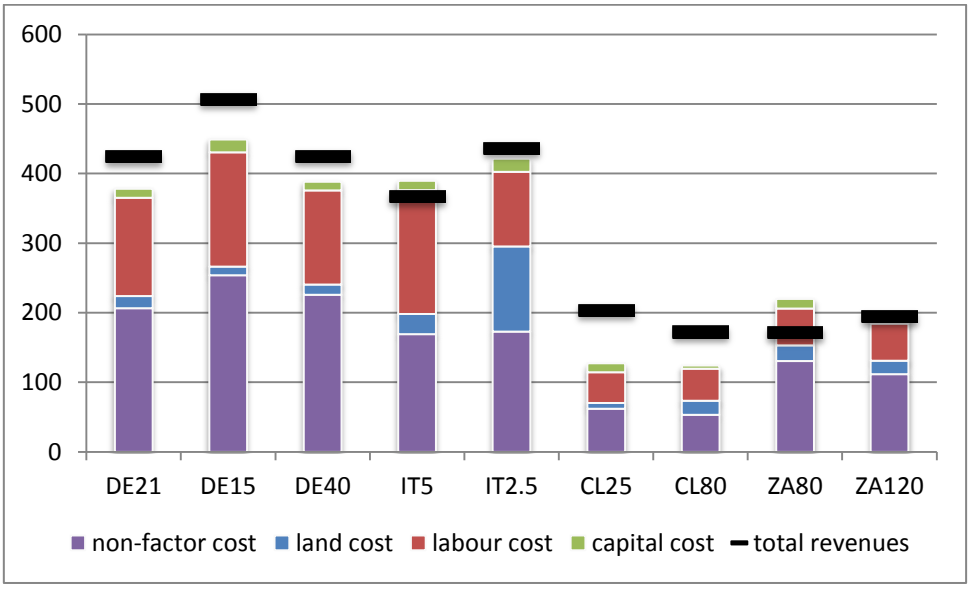
The aim of the figure and table presented here is to offer an overview of the total cost of production, as well as the cost structure in the different countries analysed. The cost areas defined for the analysis (land, labour, capital and non-factor costs) are shown as stacked bars, whose summed height represents the total cost level. Apple prices are depicted are shown as a line. Note that the aim of this section is to compare the typical farms on the basis of the base scenario, therefore showing only the figures referred to the 'with legislation' situation.

Table 4.69 – Apple production costs in selected countries, 2010

	unit	DE21	DE15	DE40	IT5	IT2.5	CL25	CL80	ZA80	ZA120
land cost	€/t	17.31	12.50	14.61	29.28	122.23	8.36	20.13	22.56	19.30
labour cost	€/t	141.13	164.28	135.13	177.72	107.04	44.39	46.05	52.99	53.11
capital cost	€/t	12.84	18.07	12.44	13.34	18.97	12.57	4.84	13.67	13.17
non-factor cost	€/t	206.66	253.88	226.00	169.02	173.02	61.88	53.33	130.64	111.81
total cost	€/t	377.95	448.73	388.17	389.36	421.26	127.19	124.34	219.87	197.39
Apple price	€/t	424.70	507.17	425.22	359.24	386.70	203.75	172.58	171.60	194.47

Own calculation

Figure 4.35 – Apple production costs in selected countries, 2010



Own calculation

There is a significant difference in total production costs between the two European and the two Third Countries. Particularly in Chile, per ton production costs are only one third of those in the

Italian 2.5 ha (Trentino) farm and the German 15 ha (Lake Constance) farm. Likewise the South African apple farmers produce at roughly 50% lower costs, as compared to the European producers. These lower production costs can be attributed to the higher yields in the typical apple farms of Chile and the far lower labour costs in both South Africa and Chile. Moreover, the larger farm size allows for the exploitation of economies of scale. Revenues are however also significantly lower. The two typical South African farms do not cover their full costs. For the European farms, in 2010 all typical farms except for the Italian Emilia Romagna region (IT5), achieve full cost recovery.

The most important costs in apple production for all countries are labour costs and non-factor costs. Labour costs are important for all typical apple farms. For most farms they account for about one third of total costs. The lowest share of labour costs is reported for the South African farms with about 25% of total costs, while the highest are reported in Italy, Emilia Romagna with about 45%. The most important operations carried out manually are harvesting, pruning and fruit thinning. Mechanization of these operations is only partially possible and not yet common. Non-factor costs, including depreciation, input use and irrigation as well as services, contractors and fees account for about 41 to 43% for Italian farms, and up to 58% in Germany and South Africa. Differences are high and reflect the structure of the production systems, (e.g. in depreciation costs for machinery, buildings and farm equipment). Two effects are observed here. First of all the higher mechanization in the German and Italian typical farms versus the farms in South Africa and Chile. Depreciation costs on Germany's typical farms are about 3 times higher than those for South African farms while the differences between Chile and Italy are even greater. The second effect is the economies of scale, with higher depreciation costs for smaller farms. Basic equipment and machines are needed irrespectively of the size of the farm, even though on small farms they are not used at full capacity. In input use, there are differences between the countries, though smaller in magnitude.

Capital and land cost are of less importance for total production costs, with the exception of the Italian Trentino region (IT2.5). Here the cultivated area is limited to the valleys and land prices are extremely high.

Productivity per ha is another important driver of costs per output. Relatively low productivities in Germany contribute to high production costs, whereas the high yield per ha for the Italian farms are one of the reasons why these very small farms are economically viable.

Table 4.70 – Drivers for differences in production cost of apples, 2010

cost item	DE21	DE15	DE40	IT5	IT2.5	CL25	CL80	ZA80	ZA120
Land (€/ha)	531.90	422.36	461.54	1,464	7,400	525	1,050	1,038.45	1,032
Productivity (ton/ha)	30.72	33.78	31.60	50.00	60.54	62.78	52.16	46.03	53.48
Depreciation costs (€/t)	44.13	50.63	44.26	57.46	83.37	25.03	4.94	15.39	12.54
Pesticides (€/t)	28.96	40.13	28.72	23.00	25.31	14.44	9.12	27.12	18.84

4.7.5. Selected legislation

The present section delineates the directives and regulations investigated for the apple case study, highlighting the existing differences among the four countries studied.

The directives and regulations were chosen and clustered into two groups: the environment and food safety. Specifically, "the environment" (ENV) refers to the Nitrate Directive, the Directive on Plant protection products, the Directive on Sustainable use of pesticides, and the Good Agricultural and Environmental Conditions (GAECs). "Food safety", on the other hand, refers to the cluster of legislation coded as FS6, which covers procedures in matters of food safety and hygiene of foodstuffs.

The comparative analysis is developed by means of two tables, which indicate the actions required by each piece of legislation as well as the country where they are applied. Furthermore, the tables give an indication as to which legislation has the potential to generate a cost saving, if not enforced.

4.7.5.1. Legislation requirements

An initial level of comparison contrasts the directives selected for each of the areas investigated (the environment and food safety) across their specific requirements. The inquiry discriminates whether the requirements are applicable to each of the countries chosen and how they have been transposed into the national set of norms. The aim of the table is to offer an immediate insight in the binding legislative conditions affecting apple production. The two Third Countries are included in the comparison together with the EU Member States in terms of the covering equivalent environmental and food safety areas, without an explicit reference to their peculiar body of laws.

The information resulting from the analysis of legislative requirements sets the foundation for the subsequent analysis of the cost of compliance.

Table 4.71 – Specific normative requirements of selected legislation for apple production

code	legislation	DE	IT	CL	ZA
ENV	**Nitrate Directive (91/676/EEC)**				
	o Nitrate Vulnerable Zones (NVZ)	o	x	o	o
	o ban on use of chemical fertiliser/manure in autumn and winter	x	x	o	o
	o ban on N on water-logged or frozen ground	x	x	x	o
	o buffer strips to water courses inside NVZ	x	x	o	o
	o establish fertiliser planning	x	x	x	o
	o establish farm-based nutrient balance	x	x	x	o
	o soil sampling	o	o	x	o
	o min capacity for manure storage	x	x	o	o
	o max level of N from manure (kg/ha/year)	170	170	o	o
	o max level of fertiliser for each crop	o	x	o	x
	o special storage vessels for manure	x	x	o	o
	o special equipment to avoid leakage/structural defects	x	o	o	o
	o record application of fertiliser	x	x	x	x
	o use catch crops on maize land	x	o	o	o
	o conditions for transport of excess manure	x	o	o	o
	Regulation on Plant protection products (1107/2009/EC) and Directive on Sustainable use of pesticides (2009/128/EC)				
	o register of approved plant protection products	x	x	x	x
	o approval of pesticides limited to certain crops	x	x	x	x
	o pesticide guidelines	x	x	x	x
	o apprenticeship/training to use pesticides	x	x	x	x
	o obligatory sprayer inspections	x	x	x	x
	o requirements on storage rooms for pesticides	x	x	x	x
	buffer strips to water courses	x	x	x	x
	o outdoor cleaning or special washing facility for sprayers	x	x	x	x
	o obligatory inside cleaning of sprayer on-field	x	x	x	x
	o precautions for disposal of empty pesticide containers	x	x	x	x
	o keep records of plant protection measures	x	x	x	x
	GAEC 2 – Establishment of buffer strips				
	o ban on fertiliser on buffer strips next to water courses	o	x	x	x
	o ban on pesticides on buffer strips next to water courses	o	x	x	x
	o ban on tillage on buffer strips next to water courses	o	x	o	o
	GAEC 4 - Avoiding encroachment of unwanted vegetation				
	o seed down to grass unused land	x	x	o	o
	o regular mowing of unused land	x	o	o	o
	o protect agricultural area from the invasion of trees and bushes	x	x	o	o
	GAEC 5 - Retention of landscape features				
	o ban on removing landscape features	x	x	o	o
FS6	**Regulation on General principles of food law (178/2002) and**				

code	legislation	DE	IT	CL	ZA
	Regulation on Hygiene of foodstuffs (852/2004)				
	o place on market safe products	x	x	x	x
	o inform authorities when handling unsafe food	x	x	x	o
	o collaborate to reduce risks				
	o keep records of input products and suppliers	x	x	x	x
	o keep records of products sales	x	x	x	x
	o keep records of foodstuff inspections	x	x	x	x
	o separate food storage from pesticides, diesel, oil	x	x	x	x
	o obligatory foodstuff inspections if contamination is suspected	x	x	x	x
	o recall of foodstuff in case of contamination	x	x	x	x
	o ensure hygienic handling of foodstuff	x	x	x	x

Symbols: x = enforced in the country; o = no specific legislation

A. ENVIRONMENT

The **Nitrate Directive (91/676/EEC)** applies to all EU Member States. The aim of the Nitrate Directive is the protection of ground and surface water from pollution caused by nitrates deriving from agricultural sources. It also encourages the adoption of good farming practices.

In Italy, specific nitrate vulnerable zones (NVZ) have been established, where a farmer must comply with the nitrate action programme. However, good agricultural practices and cross compliance measures are compulsory requirements for the entire country. In Germany, there is no distinction between nitrate vulnerable zones and non-vulnerable zones. All farmers have to comply with the nitrate action programme, which is valid for the entire country. Specific requirements aim to ensure that nitrogen is applied only when uptake through the crop is possible. Therefore, application on frozen or water-logged land and late autumn or winter is not allowed. For Germany and Italy, fertilizer planning and the calculation of farm level nutrient balances based on fertilization and nutrient export in the harvested product are compulsory. Soil samples are recommended but not compulsory if reference soil nitrogen contents for the soil type are used. For the protection of surface water, buffer strips along water courses have to be kept where no fertilization is allowed. There are a number of requirements particularly for the management of animal manure, such as maximum application of nitrogen from manure and storage capacity. These do apply for Germany and Italy in principal, however are not relevant for apple production, where the application of manure is not common. Similarly, other compulsory measures such as sowing catch crops are not applicable to specialized apple farms.

In South Africa and Chile, legislation is enforced aiming to protect ground and surface water from nitrate pollution. However there are differences in the specific requirements (e.g. maximum levels of nitrogen fertilization are not differentiated according to mineral fertilizer or manure). There is no

regulation on application during winter, and nutrient balances are only required in Chile. Record keeping is a legal obligation also for Chilean and South African farmers.

The **Directive on Plant protection products (91/414/EC)** regulates the trade and use of plant protection substances and active ingredients within the EU. The norm also describes the procedure necessary to achieve an authorization for new pesticides, and how these products can be placed on the market. At farm level, specific requirements exist that affect production: (1) farmers can only use plant protection products authorized for sale under current legislation; and (2) farmers must follow the usage specifications provided by the manufacturers. Both specifications also apply to the Third Countries considered.

The **Directive on Sustainable use of pesticides (2009/128/EC)** aims at establishing closer monitoring and training for pesticide application in the Union. Consequences for farmers include:

- attending a training course and being granted a certificate, in order to use the product;
- record-keeping of pesticide applications;
- maintaining a buffer stripe without pesticide application along water courses
- compliance with a number of detailed requirements for storage facilities;
- inspection of sprayers;
- cleaning the sprayer(s) exclusively on the field or in special washing facilities.

The buffer stripes along water courses, where no pesticides may be applied, are to avoid any direct contamination of the surface water through drift during application. In the German apple production region Altes Land, a special directive allows smaller buffer strips along water courses, conditional on using appropriate spraying techniques and documentation of water levels during application. With regards to plant protection and application of pesticides, South African and Chilean apple producers have to comply with similar requirements, which are partially enforced by national law, partially required, and hence strictly controlled, by certification schemes such as GlobalGap or Tesco Nurture. These requirements are obligatory conditions for local farmers to access export markets. Private standards in this study have been considered and accounted for only when they are in fact compulsory for import/ export activities and they have an effect on the product's competitiveness at world level and the EU level.

Even though all the countries included in this case study fully transposed the directive into their national legislation only by December 2011, for the purposes of the analysis it was assumed that full implementation was already achieved in 2010, and costs were anticipated.

Within the **Good Agricultural and Environmental Conditions (GAECs)** defined in the framework of cross compliance, different minimum standards are addressed. The implementation of the GAECs differs from member state to member state.

For apples, a permanent crop, GAEC 1 and 6 regarding minimum soil cover and land management were not found relevant.

In 2010 GAEC 2 on buffer strips was implemented in Italy. In Germany, farmers are required to keep buffer stripes for nitrogen (Nitrate Directive) and for pesticides (Directive on the sustainable use of pesticides). Chile and South Africa require buffer strips for fertilizer and pesticide application as explained above.

Due to GAEC 4 on avoiding the encroachment of unwanted vegetation, farmers in the EU have to mulch used arable land either every year or every second year. Such a condition does not apply to Third Country farmers, where mulching of unused land is not regulated.

The retention of landscape features (GAEC 5) is implemented in all EU Member States investigated, however no similar regulation exists in Chile or South Africa.

A. FOOD SAFETY

The group "**Food Safety 6**" applies to Germany and Italy and contains two regulations, which set specific procedures in matters of food safety and hygiene of foodstuffs. Similar requirements have to be fulfilled in Chile and South Africa.

4.7.5.2. Cost items list and potential impact at farm level by country

In the following table, the cost items generated by the implementation of the legislation at farm level are listed. The list is based on the information collected via the experts and the panels carried out in each country to identify real additional costs faced by the farmers in order to comply with the legislation. The cross indicates in which country the cost item was identified as a compliance cost. In many cases, the requirements were considered as useful, good agricultural practices and farmers would comply even without a legal obligation to do so. In these cases, compliance costs are null.

Table 4.72 – Comparison of legislative areas impacting cost of compliance in apple production

	legislation	Item	DE	IT	CL	ZA
ENV	Nitrate Directive	limit to N fertilizer application				x
		perform soil and leaf nutrient analysis			x	
	Plant protection products	pesticide storage	x	x	x	x
		buffer zones along water courses for pesticide application	x			
		washing area for sprayers disposal of empty containers		x	x	
		pesticide spraying equipment utilization period for sprayers	x	x		
		official technical revision for pesticide application equipment	x		x	
		procedure for pesticide registers/traceability	x	x	x	x
	Regulations 178/2002; 852/2004	perform food samples		x	x	
		HACCP		x	x	
		hygiene procedures and cleaning equipment		x	x	

Symbols: x = identified as compliance cost

4.7.6. Cost of compliance with selected legislation

The aim of the section is to analyse the costs of compliance with the legislations clustered as "the environment" and "food safety" for the typical farms studied. The analysis does not detail the cost items used above for the comparative analysis of production costs, nor is revenue part of the objective at this point.

Table 4.73 – Cost of compliance with environmental legislation for apples in selected countries

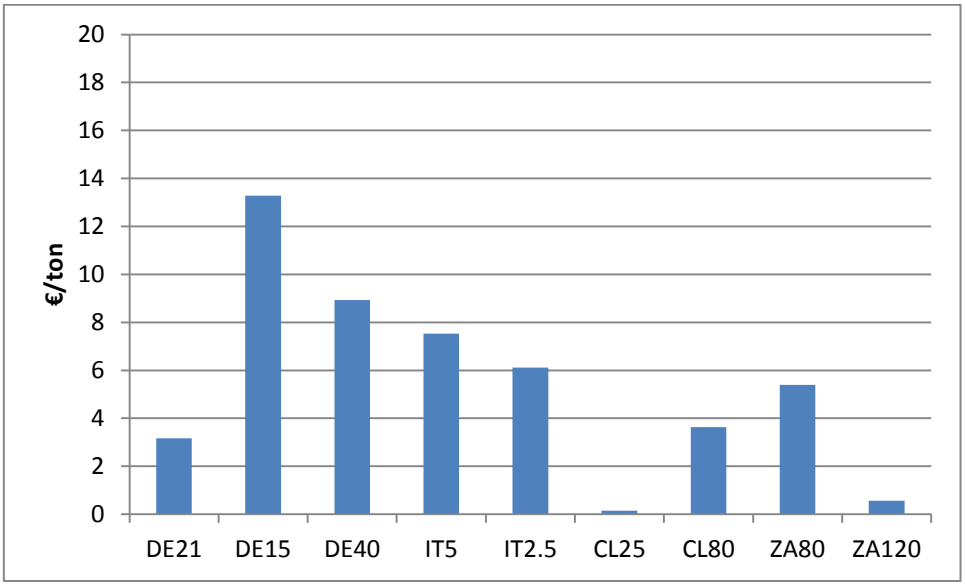
		unit	base	without ENV	difference	% change
Germany	DE21	€/t	377.95	374.79	3.16	0.84
	DE15	€/t	448.73	435.45	13.28	2.96
	DE40	€/t	388.17	379.25	8.93	2.30
Italy	IT5	€/t	389.36	381.83	7.53	1.93
	IT2.5	€/t	421.26	415.14	6.12	1.45
Chile	CL25	€/t	127.19	127.04	0.15	0.12
	CL80	€/t	124.34	120.70	3.64	2.92
South Africa	ZA80	€/t	219.87	214.48	5.39	2.45
	ZA120	€/t	197.39	196.82	0.57	0.29

Own calculation

Table 4.73 shows the cost of compliance with legislation in the field of environment in typical apple farms. The second column in the table indicates the code of the typical farm, referring to a specific country and farm size. The fourth column, labelled "base", indicates the costs of production in

2010, including compliance with all relevant legislation; the "without" column provides the cost of production calculated according to the 'without-legislation' scenario. The values that appear under "difference" express the cost of compliance with environment legislation, expressed both in €/ton and in percentage.

Figure 4.36 – Cost of compliance with environmental legislation for apples in selected countries



Own calculation

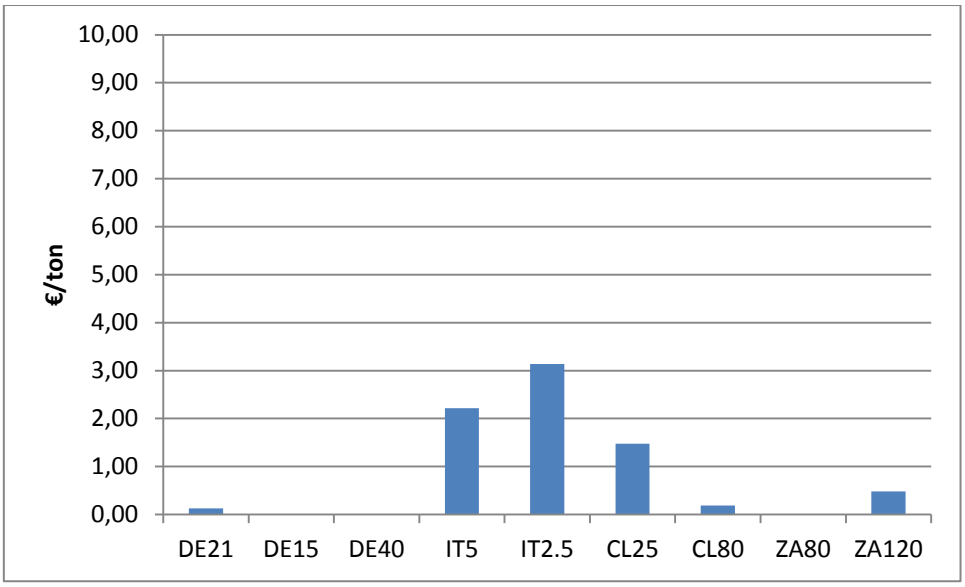
Figure 4.36 is a graphical presentation that results from Table 4.73 and complements the analysis. Overall, the cost of compliance with environmental legislation is low, ranging between 0.12% to a maximum of 2.96%. The relatively great cost impact on the German (DE15) farm is due to the effect of buffer strips on total production. With smaller buffer strips, an additional 6 tons of apples would have been harvested. Since the farm is relatively small, the necessary investment in spraying equipment weighs proportionally more than on the other German farms. The major cost of compliance for the Italian apple producers is the limited choices of plant protection products. The respondents in the focus group discussion estimated significant cost savings if they were still allowed to use cheaper pesticides which are no longer approved for apples. In the South African farm in EGVV (ZA80), the major compliance cost refer to foregone yield on less fertile plots, where less nitrogen can be applied than the producers would do without the legislation.

Table 4.74 – Cost of compliance with food safety legislation for apples in selected countries

		unit	base	without FS	difference	% change
Germany	DE21	€/t	377.95	377.82	0.13	0.03
	DE15	€/t	448.73	448.73	0.00	0.00
	DE40	€/t	388.17	388.17	0.00	0.00
Italy	IT5	€/t	389.36	387.14	2.22	0.57
	IT2.5	€/t	421.26	418.12	3.14	0.75
Chile	CL25	€/t	127.19	125.72	1.48	1.16
	CL80	€/t	124.34	124.15	0.19	0.15
South Africa	ZA80	€/t	219.87	219.87	0.00	0.00
	ZA120	€/t	197.39	196.91	0.48	0.24

Own calculation

Figure 4.37 – Cost of compliance with food safety legislation for apples in selected countries



Own calculation

Table 4.74 and Figure 4.37 presented above illustrate the cost of compliance for food safety. The cost of compliance for food safety regulations are very low for all farms analysed. In general, participants of group discussions in all case study regions reported that issues regarding traceability, food hygiene and safety are common modern business practices these days and would be done with or without legislation. However, there are some items that do cause costs, (e.g. in Italy, where the specific requirements for record keeping require more labour time than the farmers would invest without the legal obligation). Since farms are small with only 5 and 2.5 ha, even a few hours of extra labour have a visible cost impact, which would not be significant on a larger farm since the labour time for record keeping is not proportional to area or production. In CL80, the high standards

required for sanitary infrastructure for workers, sampling fees for water and apples as well as specific record keeping were identified as major cost items.

Table 4.75 and Figure 4.40 offer a broader comparison among the environment and food safety areas in terms of percentage change with respect to the base situation. Two of the typical farms studied experienced a small cost effect due to requirements equivalent to the Nitrate Directive: the ZA80 farm as explained above, and the CL25 farm, where soil nutrient analysis costs would be saved without the requirement. The remaining environmental requirements refer to the area of plant protection and sustainable use of pesticides. Building specific pesticide storage rooms, investing in new spraying equipment, the use of more expensive pesticides, record keeping obligations and the effect of buffer strips on total production are the major cost items. Food safety regulations cause lower costs. The CL25 farm was the only one where the investment in sanitary infrastructure and specific hygiene procedures had a higher impact than environmental requirements.

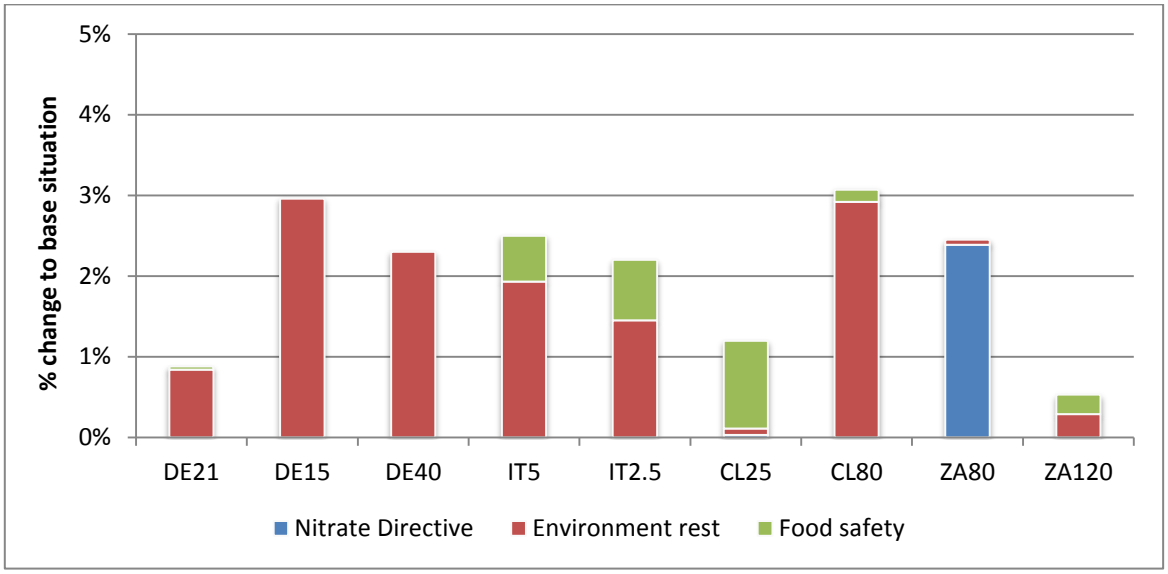
Table 4.75 – Comparison of percentage change to base by normative area: apples

	Nitrate Directive	other ENV	Food safety	TOTAL
DE21	0.00	0.84	0.04	0.88
DE15	0.00	2.96	0.00	2.96
DE40	0.00	2.30	0.00	2.30
IT5	0.00	1.93	0.57	2.50
IT2.5	0.00	1.45	0.75	2.20
CL25	0.03	0.08	1.09	1.20
CL80	0.00	2.92	0.15	3.13
ZA80	2.39	0.06	0.00	2.45
ZA120	0.00	0.29	0.24	0.53

Own calculation

Two of the typical farms studied experience a limited cost effect due to requirements equivalent to the Nitrate Directive: the South African ZA80 farm, as explained above; and the Chilean CL25 farm, which is obliged to build specific pesticide storage rooms, invest in new spraying equipment, use of more expensive pesticides, and maintain record keeping obligations. Only in this farm the investment in sanitary infrastructure and specific hygiene procedures has a higher impact than environmental requirements.

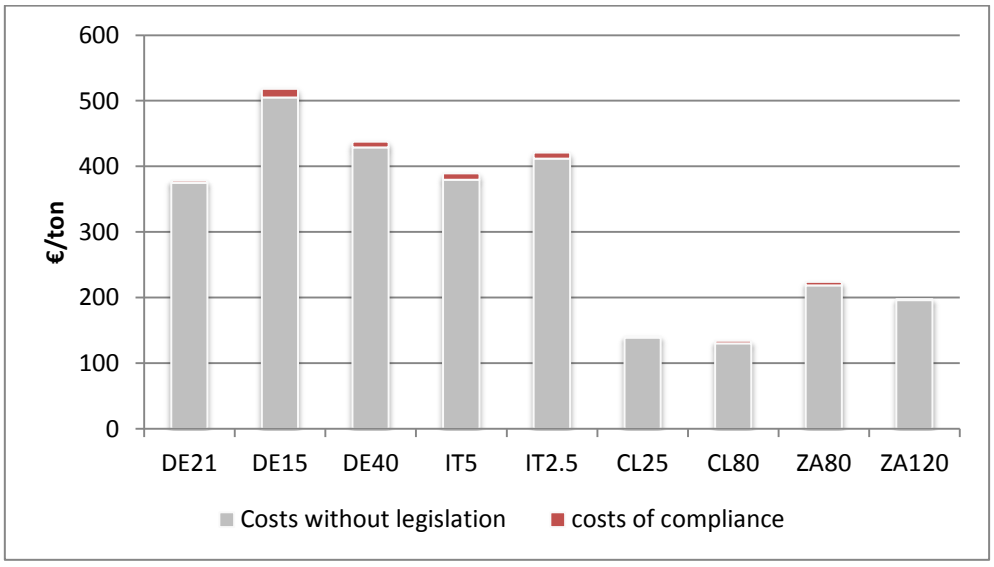
Figure 4.38 – Comparison of percentage change to base for compliance with nitrate directive, other environmental legislation and food safety legislation: apples



Own calculation

The figure below compares the total cost with and without legislation for the apple typical farms.

Figure 4.39 – Comparison of with and without legislation costs for apple



Own calculation

The compliance costs of the analysed farms are relatively low and do not exceed 3.13 % of the total costs. This is in line with some farmers' perception that environmental regulations, particularly the record keeping obligations are "more a nuisance than a cost". However, investments in pesticide storage rooms or specific infrastructure for food safety are sometimes perceived as high cost

investments. Yet, depreciating the investment in pesticide storage or modern pesticide application equipment over 10 to 20 years, leads to a very low effect on production costs per ton of product. The other important cost of compliance in apple production consists mainly in labour costs for documentation. In comparison to the very high labour inputs for pruning, plant protection and harvesting, the few extra hours of keeping records result in relatively low extra costs.

Another reason for rather low compliance costs is that even without some of the regulations, farmers would not change their management practices. They perceive them as good agricultural practices and see benefits in these practices. For instance, Chilean and South African apple producers pointed out that protecting ground water from nitrate or pesticide pollution was in their genuine interest, and documentation of pesticide and fertilizer application is an important part of good farm management for most farmers.

The cost of compliance is very similar for the European farms, although different types of costs were identified in the different countries. Within Germany, a difference was found between the producing regions: In the Northern region of Altes Land, apple orchards are usually along water courses and buffer strips for pesticide application are regulated with a specific rule. Therefore, farmers did not consider the compliance with buffer strips and the associated losses in yields or qualities as a cost. In contrast, in the Lake of Costance region, where much less area of the orchards are affected by buffer strip regulation, the yield loss on this area was accounted for as cost by the farmers. In Italy, buffer stripes did not play a role, but the restrictions on the choice of pesticide products were estimated to cause costs compared to the without legislation scenario.

The production costs per ton of apples differ much more between the farms than the compliance costs: The production costs in the European farms are more than twice as high as compared to Chile and 1.5 to 2 times as high as in South Africa. The compliance costs do not explain the differences at all in productions costs. The differences in production costs are mainly driven by the labour costs, which differ widely between European and Third Countries. Within Europe, Italy has the largest difference between the farms with 107 €/t in the small farm in Trentino and 177€/t in the 5 ha farm in Emilia Romagna. Germany's apple farms fall in this range with 135 €/t to 164 €/t (Table 4.71). The differences within Europe can be explained through the use of highly productive family labour in the small farms and higher yields in the Trentino farm. The level of labour costs in Chile and South Africa is much lower, with 45 €/t to 53 €/t, due to much lower wages.

Another driver for differences in production costs are the machinery costs which are related to the labour costs (see Table 4.59). In Germany and Italy, depreciation costs are 44 €/t to 57 €/t, with particularly high costs on the very small farm IT2.5 of 83 €/t. Mechanization is used to substitute

labour since wages are high. In Chile and South Africa, with very low wages, machinery costs are also low with 4 to 25 €/t. Economies of scale on the large South African farms and the 80 ha Chilean farm (CL80) also contribute to low machinery costs.

Finally the yield level is an important determinant for the average production costs per tonne. Non-factor costs for establishment of the plantation and irrigation systems, as well as labour for orchard and farm management are similar on a per ha basis. However, yields vary largely between the countries, with 30 to 33 t/ha in Germany and Chile reporting highest yields of 52 to 62 t/ha. For Italy, the high yields of 50 to 60 t/ha compensate for the very high costs for machinery, and land. Hence total production costs are similar to Germany.

4.8. Case study: Wine grapes

4.8.1. Choice of countries

Wine grapes are hardly traded as a commodity and if so, only on a limited, regional basis. Thus, in a given country, wine is produced mainly from national wine grapes. Even though in this study the focus is on the production of the raw product, (i.e. wine grapes), and not on the final product, (i.e. wine), both are closely related and the countries we have included were chosen on the basis of the relevance of their wine production.

Globally, the EU Member States France, Italy and Spain rank among the top-5 wine producing nations. Of the newer wine producing EU member states, Bulgaria and Romania- Bulgaria was also included in the project, representing a wine production system in transition, in comparison to the traditional western European wine producing nations.

Relevant wine producers from outside the EU include the USA, China, Argentina, Australia, South Africa and Chile. Among these countries, Australia exported the most in 2009, both in terms of quantity and of value, followed by Chile, the USA, South Africa and Argentina (FAOSTAT, 2012). The share of exports going to EU-27 countries is highest for Australia, Chile and South Africa. Since not all countries can be covered by means of case studies, only Australia and South Africa were selected as Third Countries wine grape producing countries.

4.8.2. National farm structure

Among the six countries analysed, Spain has the largest vineyard surface with more than 1 million ha, followed by France and Italy. Australia, South Africa and Bulgaria all range between 156,600 and 82,600 ha (Table 4.76 and Table 4.77).

When looking at the wine production, the ranking is different: Due to higher productivity levels, France and Italy both produce about 45 million hl, which is 10 million hl more than Spain. Australia and South Africa are quite similar with approximately 9 to 11 million hl each. Bulgaria is far behind since a large proportion of its vineyard area is abandoned and thus the production is rather low with only 1.2 million hl. However, Bulgaria has a fairly large production of wine spirits which is not counted under wine production.

Table 4.76 – General country information, EU Member States (2010)

	unit	Bulgaria	France	Italy	Spain	EU27
Total vineyard area	ha	82,675	829,806	710,144	1,022,111	3,358,513
Vineyard in full production	ha	49,438	798,027	670,107	n.a.	
Vineyard not yet full bearing	ha	7,530	31,779	40,037	n.a.	
Share red/white/spirits	%	63/31/6	56 / 44	50 / 50	50 / 50	
Wine grape harvest	ton	210,398	5,794,433	6,478,743	5,875,000	24,314,504
Wine production	hl	1,224,199	45,317,024	44,693,177	34,770,000	
Ø wine yield[1]	hl/ha	25	57	67	34	
Total number of producers[2]	number	135,462	85,306	388,881	381,089	
Ø ha per producer	ha/producer	0.4	9.1	1.7	2.7	
PDO wines in total production	%	3	50	30	40	
Currency		BGN	EUR	EUR	EUR	EUR
GNI per capita[28]	US$	13,460	34,970	31,930	31,170	-

[1] *For some countries, this figure might be distorted since wine grapes may also be processed into other liquids besides wine, such as brandy*

[2] *Data from 2009, except Italy, 1999*

Source: Agrostat BG 2012, Eurostat 2012, Agreste 2012, ISTAT 2012; Italian Agricultural Census 2010, ESYRCE 2011

[28] Gross National Income (GNI) per capita is based on purchasing power parity (PPP). The indicator is calculated converting gross national income to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.

Table 4.77 – General country information, Third Countries (2010)

	unit	Australia	South Africa	World
Total vineyard area	ha	156,632	101,016	7,085,571
Vineyard in full production	ha	151,789	93,198	
Vineyard not yet full bearing	ha	4,843	7,818	
Share red/white/spirits	%	55 / 45	44 / 56	
Wine grape harvest	ton	1,592,706	1,261,309	66,920,681
Wine production	hl	11,244,980	9,326,954	
Ø wine yield[1]	hl/ha	74	100	
Total number of producers	number	6,679	3,596	
Ø ha per producer	ha/producer	23	28	
Currency		AUD	ZAR	-
GNI per capita[25]	US$	37,580	10,350	-

[1] *For some countries, this figure might be distorted since wine grapes may also be processed into other liquids besides wine, such as brandy*

Source: FAOSTAT, Australian Bureau of Statistics; Wine Grape Growers Australia; Wine Australia; Winebiz.com.au, SAWIS 2011 & 2012

In most countries, red and white wine varieties are produced in about equal shares. Only in Bulgaria are red grapes the majority (63%).

The number of producers is only counted every few years. Based on the most recent data available, Italy and Spain have by far the largest number of wine grape growers, namely 381,000 to 389,000. Thus, the average acreage cultivated by producers in these countries is rather low and amounts to 1.7 ha to 2.7 ha. In France, scale is larger and producers cultivate on average 9 ha. However, overseas, in Australia and South Africa, the average cultivated area is almost ten times larger and ranges between 23 ha and 28 ha per producer, respectively.

4.8.3. Description of typical farm structure

Data concerning a total of 11 typical wine grape farms could be collected for this project. Spain is the only country represented by three farms, while Bulgaria and France are represented by only one farm each. Out of the 11 farms, 9 farms produce wine grapes and sell them to cooperatives or other buyers, mainly under contract or on the spot market. The remaining 2 farms further process the wine grapes into wine on farm (FR20L and IT10V). However, for all farms the production and legislation was assessed up to the point of the wine grape harvest.

The typical farms are described by means of key figures, summarized in two tables for the four EU Member States (Table 4.78 and Table 4.81) and one table for the two Third Countries (Table 4.80).

BG500T The Bulgarian LTD typical farm has the largest acreage with 500 ha and has an associated winery which operates as a separate company. It is very modern and it is constantly renovating large surfaces of old vines, while purchasing modern machinery with the help of European subsidy programmes. Between 4,000 and 5,480 vines per hectare are planted. Mavrud is the main variety grown in this typical farm. Given that salaries in Bulgaria are the lowest compared to the other countries, the Bulgarian typical farm is the only one which still relies on 50% of harvest by hand. Thus, the time worked per ha is the highest here, with 419 hours.

ES130M The Spanish, 130 ha farm is a top producer in Castilla La Mancha and it is most likely, in the long run, to survive the structural changes going on in that region. The grapes, harvested with machines, are sold to a few selected wineries. Spain is the only country among the four analysed receiving decoupled payments (215 or 280 €/ha) and additional funds to modernize its production techniques, such as trellising, irrigation and selection of different varieties. About 1,400 vines are planted per hectare and the main variety is Tempranillo. On this large Spanish farm, the majority of the work is done by hired labour adding up to 121 hours spent per ha. Only the transport of the grapes is partially outsourced to contractors.

ES25M The small farm in Castilla La Mancha represents a farm in transition: 10 ha are planted with Airen in goblet, not irrigated and harvested by hand. It is a low-earning white wine variety. On the remaining 15 ha, Tempranillo is planted in a modern trellising system, using irrigation. For mechanical pruning and harvest, machines are contracted. In this typical farm about 2,000 vines are planted. This small farm predominantly relies on family labour. Despite the fact that only 10 ha of the farm vines are hand-picked, on average only 82 hours labour are required per ha. In addition, the farm spends about € 5,400 on contractors for mechanical pruning and harvest.

ES15T The wine farm in Rioja is a small family-run farm, whose production targets the premium market for Tempranillo, its only grape. Without irrigation, yields are comparably low, but due to marketing under the Denomination of Origin – Rioja label and following restricted yields, the wine grapes sold can obtain high market prices. This Rioja farm uses family labour and 25% hired labour. In total 119 hours are invested per ha and nearly € 4,000 spent on contractor services.

FR20L The 20 ha wine farm in France produces not only wine grapes, but also bulk wine which is marketed with the 'Terra vitis' label, a programme enhancing sustainable production. This farm uses a mix of family and hired labour that sometimes also comes from Spain. On average, 120 hours per hectare are worked on this typical farm.

IT5E In Italy, the ER farm is mixed, and grows 5 ha wine grapes as well as 10 ha of other fruits. Due to its small structure the farm is a member of a local cooperative to which it sells 100% of its produce. Contractor services are used for the harvest and transportation of the produce and for all other activities family labour is used. About 3,600 vines are planted per hectare with a grape production ranging from 21 to 32 tons per hectare.

IT10V The 10 ha farm in Veneto grows exclusively wine grapes, and produces high quality grapes which the family further processes on farm into wine and Prosecco wine. The varieties grown on this farms are Prosecco, Pinot Grigio and Cabernet Sauvignon. Between 2,500 and 2,500 vines are planted per hectare. The farm is relying for 100% on family labour

Table 4.78 – Typical farms: key variables of the vineyards (EU Member States: Bulgaria and Spain)

		BG500T	ES25M	ES130M	ES15R
Region		Thracian Valley	Castilla La Mancha	Castilla La Mancha	La Rioja
Total farm size (ha)		500	37	130	15
- full production		466.6	25	130	15
- non-full bearing		16.7	0	0	0
- in establishment & fallow		16.7	0	0	0
- other farm branch		0	12	0	0
Lifetime of vineyard (years)		up to 30 years	30 (average)	35	40
Average time to first full yield after planting new vines (years)		3 to 4	3	4	4
Grape yield on farm, 2010 (t/ha)		3 to 11	4.5 to 8.5	8.5 to 12	6.5
Share of irrigated vineyards (%)		0	60	100	0
Total surface of the international varieties (ha): Merlot, Pinot Noir, Syrah/Shiraz, Cabernet S., Chardonnay, Sauvignon Blanc		326.7	0	68	0
Top 3 varieties on farm	Name	Cabernet Sauvignon	Tempranillo	Tempranillo	Tempranillo
	ha	151.9	15	37	15
	Name	Merlot	Airen	Syrah/Shiraz	
	Ha	103.3	10	33	
	Name	Shiraz		Merlot	
	ha	59		26	
Vines per ha		4,000 to 5,480	2,000 to 2,100	1,200 to 1,600	1,200 to 1,600
Distance between the rows (m)		2.5	3.2	2.5-3.0	3-3.5
Less favoured area		yes: 100 ha out of 500 ha	yes	yes	no
Legal form[1]		FF	FF	FF	FF
Decoupled payment, EU subsidies (per ha)		0	215 €/ha	280 €/ha	0
Subsidies (per farm)		machinery, establish new vineyards (75% subsidy); Rural Development Fund	conversion of old vineyards, irrigation systems	irrigation systems, trellising, change of variety, conversion of old vineyards, agrarian insurance	conversion of old vineyards
Canopy management / production system		double-arm cordon	old vines: goblet; young vines: trellising system	trellising system	trellising system

	BG500T	ES25M	ES130M	ES15R
Selling on the market or delivering to cooperative	100% delivery to associated winery or processor	100% delivery to cooperative	100% delivery to selected wineries	100% delivery to cooperative
Producing and marketing bulk wine				
Producing and marketing packaged wine				
Participation in private quality certification schemes	No	no	no	PDO
Family labour (hours per year)	0	1,403	240	1,336
Hired labour (hours per year)	209,664	641	15,495	0
Seasonal workers (hours per year)	0	0	0	450
Use of own machinery	Yes	yes	yes	yes
Use of hired machinery / contractors / co-operative machine pool	only to establish new vineyards	on part of the farm pruning, harvest & transport of grapes	part of grape transport	For pruning and harvesting
Harvest	manual (50%) machine (50%)	manual (40%) machine (60%)	100% machine	100% machine

Source: Agri-benchmark Horticulture 201

Table 4.79 – Typical farms: key variables of the vineyards (EU Member States: France and Italy)

	FR20L	IT5E	IT10V
Region	Languedoc-Roussillon	Emilia Romagna	Veneto
Total farm size (ha)	20	15	10
- full production	18.5	5	9
- non-full bearing	0	0	0
- in establishment & fallow	1.5	0	1
- other farm branch	0	10	0
Lifetime of vineyard, years	40 years (average)	25 years or more	25 years or more
Average time to first full yield after planting new vines	3 years	3	3
Grape yield on farm, 2010 (t/ha)	6 to 12	21 to 32	15 to 20

		FR20L	IT5E	IT10V
Share of irrigated vineyards (%)		0	100%	100%
Total surface of the international varieties (ha): Merlot, Pinot Noir, Syrah/Shiraz, Cabernet Sauvignon, Chardonnay, Sauvignon Blanc		14	0	3
Top 3 varieties on farm	Name	Shiraz	Trebbiano romagnolo	Prosecco Glera
	ha	5	3.5	3
	Name	Merlot	Lambrusco	Pinot Grigio
	ha	3.3	1.5	3
	Name	Carignan		Cabernet S.
	ha	2.2		1.5
Vines per ha		3,600 - 4,000	3,600	2,500 – 3,500
Distance between the rows (m)		2.5	3-3.5	1.7 – 3
Less favoured area		No	No	No
Legal form		FF	FF	FF
Decoupled payment, EU subsidies (per ha)		0	0	0
Subsidies (per farm)		no	yes: 400 €/ha (regional/national)	yes: 200 €/ha (regional/national)
Canopy management / production system		Trellising system, Cordon de Royat	GDC (Geneva Double Curtain)	Sylvoz
Selling on the market or delivering to the cooperative			100% delivery to cooperative	
Producing and marketing bulk wine		100%		
Producing and marketing packaged wine				100 %
Participation in private quality certification scheme		Terra Vitis: sustainable viticulture	integrated production	integrated production
Family labour (hours per year)		1,850	600	1,500
Hired labour (hours per year)		560	0	0
Seasonal workers (hours per year)		0	0	0
Use of own machinery		yes	yes	yes
Use of hired machinery / contractors / co-operative machine pool		harvest and establishment	harvest and transport	harvest
Harvest		100 % machine	100 % machine	100 % machine

[1] *Legal form: FF = family farm business; BF = agribusiness farm; CF = cooperative farm*

Source: Agri-benchmark Horticulture 2013

The typical farms for Australia and South Africa (henceforth ZA) described here are all medium-sized family farms in their respective regions comprising 22 ha, 20 ha and 50 ha (Table 4.80). All farms have a reasonable share of young vineyards in establishment or not yet fully bearing (Australia – 10% and South Africa – 16% to 20%). While Australian vineyards are used up to 40 years, in ZA their lifetime reaches 25 years. Both countries irrigate up to 100% of the fields using drip irrigation. Modern trellising systems are common. However, yields in ZA tend to be higher and, depending on the variety, may reach up to 28 tons of grapes per ha. On the Australian farms, three international varieties are cultivated in a proportion of 41% white and 59% red. The larger ZA farms are also more diverse and cultivate a total of eight varieties (65% white – 35% red) and, among them, typical ZA ones, such as Pinotage.

The plant density differs across countries, with 2,000 vines/ha in Australia and 3,333 in South Africa. All farms produce only wine grapes and sell them to cooperatives, to private cellars or to other buyers on a contractual basis (AU) which then further process the wine grapes into wine. For farms in both countries it is common to participate in private certification schemes ensuring sustainable management practices.

The labour usage is quite different. The Australian farms have a rather equal distribution among family and hired labour, whereas the South African farms employ more than 90% hired labour who are predominantly permanent employees as well as some seasonal workers. Most of them live in staff houses on farm. The Australian, fully- irrigated farm in the Riverlands harvests with machines only and uses 124 hours of work per ha. The farm in the cool climate Barossa valley targets a premium market and still performs hand picking on its 20 ha, amounting to 135 hours per ha.

The South African farms still harvest 40% and 62% by hand and thus have a labour utilization of 734 hours/ha and 648 hours/ha, respectively with lower yields.

Contractor services are partially used during the establishment of new vineyards.

Table 4.80 – Typical farms: key variables of the vineyards (Third Countries)

		AU22R	AU20B	ZA50B	ZA50P
Region		South AU, Riverland	South AU, Barossa	Western Cape, Breedekloof	Western Cape, Paarl
Total farm size (ha)		22	20	50	50
- vines in full production		19.8	18	42	40
- vines non-full bearing		0	0	4	6
- in establishment & fallow		2.2	2	4	4
- other farm branch		0	0	0	0
Lifetime of vineyard, years		40	40	25	25
Average time to first full yield after planting new vines		4 years	4 years	Year 5	Year 6
Grape yield on farm of fully bearing vines, 2010 (t/ha)		15.1 – 15.7	5.3 – 7.3 (high quality)	15.5 – 28.4	8.3 – 16.7 (high quality)
Share of irrigated vineyards (%)		100	100, using water from a dam	100	100
Total surface of the international varieties (ha): Merlot, Pinot Noir, Syrah/Shiraz, Cabernet Sauvignon, Chardonnay, Sauvignon Blanc		21.4 ha	19.5 ha	19.7 ha	32.33 ha
Top 3 varieties	Name	Chardonnay	Chardonnay	Chenin Blanc	Chenin Blanc
	ha	8.2	6.8	13.4	11
	Name	Shiraz	Shiraz	Colombar	Cabernet S.
	ha	8.2	6.8	9.3	10.78
	Name	Cabernet S.	Cabernet S.	Shiraz	Shiraz
	ha	5	5.9	5.3	8.73
Vines per ha/plant density		2,000	2,000	3,333	3,333
Distance between the rows (m)		2.7 m	2.7 m	2.5 m	2.5 m
Legal form[1]		FF	FF	FF	FF
Subsidies (per farm)		None	None	None	None
Canopy management / production system		vertical trellis system	vertical trellis system	five-strand extended Perold	five-strand extended Perold
Grape marketing		80% to purchasers with	100 % to purchasers	100% delivery to	100 % to private cellars

	AU22R	AU20B	ZA50B	ZA50P
	contract	without formal contract; agreement to buy at current prices with quality premium	cooperative	and wholesalers
Participation in private quality certification scheme	Vitis program and EntWine	EntWine and "The Barossa Viticulture Technical Group"	Integrated Production of Wine (IPW); Wine Industry Ethical Trade Association (WIETA)	Integrated Production of Wine (IPW); Wine Industry Ethical Trade Association (WIETA)
Family labour (hours per year)	2,000	2,000	2,160	2,160
Hired labour (hours per year)	1,614	676	28,080	19,440
Seasonal workers (hours per year)	0	0	6,480	10,800
Use of own machinery	yes	yes	yes	yes
Use of hired machinery/ contractors	no	no	mainly own machinery; during establishment contractor hired	only for land preparation at establishment of new vineyards
Harvest	machine only harvest	hand harvest	40% manual, 60% machine	62% manual, 38% machine

[1] *Legal form: FF = family farm business; BF = agribusiness farm; CF = cooperative farm*

Source: Agri-benchmark Horticulture 2013

4.8.4. Cost of production

The aim of the table and figure presented here is to offer an overview of the total cost of production of wine grapes up to the point of their harvest, as well as the cost structure in the different countries analysed. The cost areas defined for the analysis (land, labour, capital and non-factor costs) are shown as stacked bars, whose summed height represents the total cost level. Prices for the wine grapes are depicted as a line. These prices are the ones farms receive when delivering the wine grapes to cooperatives or any other buyers who then further process them into wine. However, the sample of typical farms contains two farms that further process their grapes into wine on farm, namely FR20L and IT10V. For those farms, the mentioned grape price represents an internal price assuming they would sell the wine grapes to an external buyer. Note that the aim of this section is to compare the typical farms on the basis of the base scenario, therefore showing only the figures referred to the 'with' legislation situation.

The impact of capital costs on total production costs is generally minimal, with highest costs in South Africa (ZA50P), and Spain (ES15R). Land costs reach nearly 100 €/t or more in Italy (IT10V), South Africa (ZA50P) and Australia (AU20B) while they are almost irrelevant in the other countries. Labour costs show a higher variability and range from 67 €/t in Italy (IT5E) to 325 €/t in Australia, where the Barossa farm practices hand harvest for quality reasons.

Non-factor costs are the leading cost factor and comprise on average 56 % of total production cost, ranging from 136 to 570 €/t. Highest non-factor costs are found in Australia and are, to a large extent, driven by irrigation costs[29].

[29] In the Riverlands, farmers buy permanent irrigation rights to withdraw water from the river. According to official statistics, 94% of the grapevines in South Australia are irrigated (ABS, 2013). Water rights are traded goods and constitute an important farm resource. The typical farm AU22R requires enough water rights to irrigate 4 Megaliter (ML) per ha, the minimum level in that region. The average water use on vineyards is 8 ML/ha. Depending on productivity targets and actual rainfall, irrigation amounts can be up to 12 ML/ha.

Between 2006 and 2011, this region experienced an extraordinary drought. In order to secure minimum water flows in the river, for the first time in history the government began cutting the allowance to withdraw water. In the 2008 harvest year, water allocation was 32%; 18% in 2009; 62% in 2010; and 67% in 2011. For the 2012 harvest year, the allocation returned to 100%.

Due to unreliable offer for renting water rights, farmers generally preferred buying permanent rights. However prices of water rights are highly volatile and dropped sharply after rains started in 2012.

To account for the exceptional conditions in the reference year, the following pragmatic solution was found:

- the average price for the original 4 ML/ha permanent water rights which were acquired before 2010 was estimated to be AUD 1,400/ML. Yearly opportunity costs were estimated at 10% of these costs - AUD 560 per ha (=4*1,400*10%) were assigned to the year 2010.
- to estimate the cost of purchasing water rights to complement the missing 38% of actual water use in 2010, reflecting the cost of compliance with environmental legislation on water, the average price of 2,200 AUD/ML (nominal water right) was used.

Though revenues for wine grapes are partially quite high (Australia, France, Italy and Spain), in none of the cases were they able to cover the entire total costs. The production costs are compared on a per ton basis, which means that different yield levels have a big influence on production costs as well. The average yields per farm range from 5.2 t/ha in Bulgaria to 28.7 t/ha in Italy (IT5E), while the average yield across all 11 farms amounts to 11.6 t/ha.

In this context, it should be noted that specific wine legislation such as maximum yield or other obligations under designation of origin were taken as given legislation under the reference scenario.

Table 4.81 – Costs of production for wine grapes in selected countries, 2010

	unit	BG500T	FR20L	IT5E	IT10V	ES25M	ES15R	ES130M	AU22R	*AU22R**	AU20B	ZA50B	ZA50P
land cost	€/t	29.51	26.05	52.26	90.60	32.17	23.08	19.75	9.96	*9.96*	150.06	54.12	133.27
labour cost	€/t	121.00	193.25	66.90	161.07	82.12	127.30	102.53	103.21	*103.21*	325.33	73.62	162.58
capital cost	€/t	6.86	19.18	19.22	31.25	11.24	40.00	17.32	34.54	*23.28*	45.15	36.80	61.83
non-factor cost	€/t	287.33	391.51	202.04	258.13	199.41	302.85	148.99	570.36	*286.20*	364.86	136.19	247.68
total cost	€/t	444.71	629.99	340.42	541.05	324.94	493.23	288.59	718.07	*422.65*	885.40	300.73	605.36
wine grape price	€/t	167.13	500.00	293.17	485.23	174.57	475.00	176.97	187.36	*187.36*	769.55	226.67	376.12

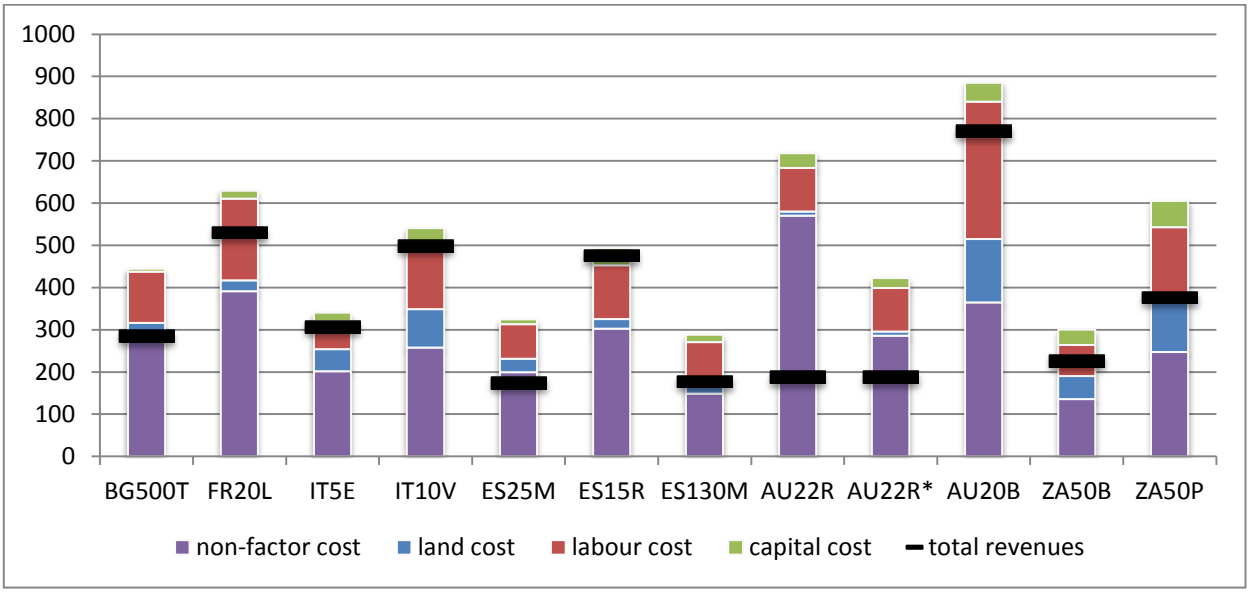
Own calculation; AU22R = production costs if in 2010 there had been no impact due to drought and no need to buy additional, expensive water rights*

Table 4.82 – Production costs drivers: wine grapes

cost item	unit	BG500T	FR20L	IT5E	IT10V	ES25M	ES15R	ES130M	AU22R	*AU22R**	AU20B	ZA50B	ZA50P
Ø Labour	€/h	1.5	12.3	16.0	16.0	6.9	6.9	8.6	11.6	*11.6*	13.4	2.3	3.5
Ø Labour input	h/t	80.6	15.7	4.2	10.1	11.8	18.3	12.0	8.9	*8.9*	24.3	31.7	46.5
Land	€/ha	154	200	1,500	1,350	222	150	200	138	*138*	834	1,032	1,238
Productivity	Ø t/ha	5.2	7.7	28.7	14.9	6.9	6.5	10.1	13.9	*13.9*	5.6	19.1	9.3
Pesticides	€/t	48	108	26	40	6	24	12	26	*26*	9	13	22
Irrigation cost var.	€/t	0	0	0	1	7	0	1	320	*36*	55	1	5

AU22R = production costs if in 2010 there had been no impact due to drought and no need to buy additional, expensive water rights*

Figure 4.40 – Comparison of wine grape production costs in selected countries, 2010



Own calculation; AU22R = production costs if in 2010 there had been no impact due to drought and no need to buy additional, expensive water rights*

The different levels of production costs can be ascribed to a number of parameters which, together with those listed in section 6.8.3, constitute the major drivers (Table 4.82). It might be surprising that production costs in Australia and South Africa are partially even higher than in Europe. However, one has to keep in mind that these figures display the situation in only one specific reference year. As mentioned before, the Australian farms experienced a long drought at the time of the reference year of the project which also coincided with low product prices. The variable irrigation costs alone account for 320 €/t, which is 56% of the non-factor costs. Assuming a "normal year"- meaning no impact due to the drought and farmers not having to purchase additional, expensive water rights- the variable costs for irrigation would drop to 36 €/t. (See second column AU22R*). Furthermore, these are the production costs only up to grape harvesting. Most of the efficiency gains from economies of scale and cost savings actually take place at the level of wine making in the cellar. Therefore, the overall competitiveness of the entire wine sectors of the countries analysed may look different as compared to the situation in Figure 4.40 particularly in the long run.

4.8.5. Selected legislation

Here the legislative requirements affecting the wine case study and their implementation in the countries chosen for investigation are presented. The 11 directives and regulations were chosen and clustered into two groups: the environment and food safety. Specifically, "the environment" (ENV)

refers to the Nitrate Directive, the Directive on Plant protection products, the Directive on Sustainable use of pesticides and the Good Agricultural and Environmental Conditions (GAECs). "Food safety" includes the norms ascribable to the area denominated FS6, which defines a number of procedures in matters of food safety and hygiene of foodstuffs. In this context it should be noted that specific wine legislation such as maximum yield or other obligations are ruled under designation of origin standards. The comparative analysis is developed in two tables, which indicate the actions required by each piece of legislation as well as the country in which they are applied. Furthermore, the table gives an indication of which legislation has the potential to generate a cost saving, if it were not enforced.

4.8.5.1. Legislation requirements

An initial level of comparison contrasts the legislation selected for each of the areas investigated (the environment and food safety) across their specific requirements. A cross in Table 6.85 indicates whether the respective legislation with its various accompanying requirements is in general applicable to the agricultural sector in the chosen country or not. Even though there might be an cross for example for the Nitrate Directive in a given country this does not mean that this directive is automatically also relevant for the specific sector of wine grape production. The two Third Countries are included in the comparison together with the EU Member States, covering the equivalent environmental and food safety areas, without an explicit reference to their particular body of laws. The information resulting from the analysis of legislative requirements sets the foundation for the subsequent analysis of the costs of compliance.

Table 4.83 – Specific normative requirements of selected legislation for wine grape production

code	legislation	BG	FR	IT	ES	AU	ZA
ENV	**Nitrate Directive (91/676/EEC)**						
	o Nitrate Vulnerable Zones (NVZ)	x	x	x	x	o	o
	o ban on use of chemical fertiliser/manure in autumn and winter	x	x	x	x	o	o
	o ban on N on water-logged or frozen ground	o	x	x	x	o	o
	o buffer strips to water courses inside NVZ	x	x	x	x	o	o
	o establish fertiliser planning	o	x	x	x	x	o
	o establish farm-based nutrient balance	o	x	x	x	x	o
	o soil sampling	x	o	o	o	x	o
	o min area covered with catch crops	x	o	o	o	o	o
	o min capacity for manure storage	x	x	x	x	x	o
	o max level of N from manure (kg/ha/year)	170	170	170	170	o	o
	o max level of fertiliser for each crop	o	x	x	x	o	o
	o special spreading conditions (max distance to water	x	x	x	x	x	x

code	legislation	BG	FR	IT	ES	AU	ZA
	bodies)						
o	special storage vessels for manure	x	x	x	x	x	o
o	special equipment to avoid leakage/structural defects	x	o	o	o	x	o
o	record application of fertiliser	x	x	x	x	x	x
o	use catch crops on maize land	x	o	o	o	o	o
o	conditions for transport of excess manure	x	o	o	o	o	o
Regulation on Plant protection products (1107/2009/EC) and Directive on Sustainable use of pesticides (2009/128/EC)							
o	register of approved plant protection products	x	x	x	x	x	x
o	approval of pesticides limited to certain crops	x	x	x	x	x	x
o	pesticide guidelines	x	x	x	x	x	x
o	apprenticeship/training to use pesticides	x	x	x	x	x	x
o	keep records of pesticide application	x	x	x	x	x	x
o	obligatory sprayer inspections	x	x	x	x	o	x
o	requirements on storage rooms for pesticides	x	x	x	x	x	x
o	buffer strips to water courses	x	x	x	o	x	x
o	outside cleaning of sprayer only on-field, or special washing places	x	x	x	x	x	x
o	obligatory inside cleaning of sprayer on-field	x	x	x	x	x	x
o	precautions for disposal of empty pesticide containers	x	x	x	x	x	x
GAEC 2 – Establishment of buffer strips along water courses							
o	ban on fertiliser on buffer strips next to water courses	o	x	x	o	x	x
o	ban on pesticides on buffer strips next to water courses	o	x	x	o	x	x
o	ban on tillage on buffer strips next to water courses	o	x	x	o	o	x
GAEC 4 - Avoiding encroachment of unwanted vegetation							
o	seed down to grass unused land/maintain minimum vegetation cover	o	x	x	o	o	o
o	regular mowing of unused land	o	x	o	o	o	o
o	Regular mulching of arable land	o	x	x	x	o	o
o	protect agricultural area from the invasion of trees and bushes	x	x	x	x	x	x
GAEC 5 - Retention of landscape features							
o	ban on removing landscape features	x	x	x	x	x	o
o	landscape features should represent a total of 1% of the UAA, otherwise they need to be planted	o	x	o	o	o	o
GAEC 6 – Minimum land management (reflecting site-specific conditions)							
o	intensive crop production close to river forbidden (minimum of 5 m buffer zone)	x	x	x	o	x	x
o	vineyards are not ploughed in the direction of the earth slope on areas with slopes greater than 15%	o	o	o	x	o	o

code	legislation	BG	FR	IT	ES	AU	ZA
FS6	**Regulation on General principles of food law (178/2002) and Regulation on Hygiene of foodstuffs (852/2004)**						
	○ place on market safe products	x	x	x	x	x	x
	○ inform authorities when handling unsafe food and collaborate to reduce risks	x	x	x	x	x	x
	○ keep records of input products and suppliers	x	x	x	x	x	x
	○ keep records of products sales	x	x	x	x	o	x
	○ keep records of foodstuff inspections	x	x	x	x	x	x
	○ separate food storage from pesticides, diesel, oil	x	x	x	x	x	x
	○ obligatory foodstuff inspections if contamination is suspected	x	x	x	x	x	x
	○ recall of foodstuff in case of contamination	o	x	x	x	x	x
	○ ensure hygienic handling of foodstuff	x	x	x	x	x	x

Symbols: x = enforced in the country; o = no specific legislation

A. ENVIRONMENT

The **Nitrate Directive (91/676/EEC)** applies to all EU Member States. Farmers in the selected Third Countries, Australia and South Africa, have to comply only with a few selected requirements, similar to those of the European Nitrate Directive such as recording fertiliser applications and respecting special spreading conditions. The Directive aims at protecting ground- and surface water from the pollution caused by nitrates deriving from agricultural sources, and it additionally encourages the adoption of good farming practices. Its implementation takes place through the establishment of Nitrate Vulnerable Zones (NVZs). If a territory is classified as an NVZ, the producer must comply with an NVZ Action Programme, which includes a number of measures.

The Directive has been implemented differently among the Member States, due to adjustment to national conditions and requirements. In all Member States, nitrate vulnerable zones (NVZs) were established, where farmers must comply with the action programme. However, good agricultural practices and cross compliance measures are compulsory requirements for the entire country.

When it comes to wine grape production in particular, the Nitrate Directive is hardly relevant. This is mainly due to two reasons, if at all; grape producers apply only very little fertilizer during the vegetation period and grape farms rarely keep livestock. Therefore, the provisions for maximum N application and manure storage do not apply to this sector.

In Australia, legislations partially comparable to the European Nitrate Directive exist at state or local level. They are only relevant and applicable for dairy farms, however not for wine grape growers. Furthermore, Australia applies the polluter-pays principle, meaning that farms harming the environment are held responsible and need to bear the costs.

The **Directive on Plant protection products (91/414/EC)** regulates the trade and use of plant protection substances and active ingredients within the EU. The norm also describes the procedure necessary to achieve an authorization for new pesticides and how these products can be placed on the market. At farm level, specific requirements are in place that affect production: (1) farmers can only use plant protection products authorized for sale under current legislation; and (2) must follow the usage specifications provided by the manufacturers. Both specifications also apply to the Third Countries considered.

The **Directive on Sustainable use of pesticides (2009/128/EC)** aims at establishing closer monitoring and better training for pesticide application in the Union. Consequences for farmers include:

- attending a training course and being granted a certificate in order to use the product;
- record-keeping of pesticide applications;
- compliance with a number of detailed requirements for storage facilities;
- inspection of sprayers;
- cleaning the sprayer(s) exclusively on the field or at special washing facilities.

Laws, and in particular private standards of the buyers that the farms in South Africa and Australia have to comply with, require more or less the same things since the final products compete in a global market where, among other concerns, traceability is increasingly important. Furthermore, these countries also want to protect their environments and are concerned about workers' health.
Even though all study case countries had to fully transpose this directive into national legislation by 14th December 2011, in the analysis it was assumed that the directive was already fully applied in the reference year 2010 and costs were anticipated.

Within the **Good Agricultural and Environmental Conditions (GAECs)** defined in the framework of cross compliance, different minimum standards are addressed. The implementation of the GAECs differs from Member State to Member State. For wine grapes, a permanent crop, GAEC 1 regarding minimum soil cover was not found relevant.
In 2010, GAEC 2 on buffer strips was implemented in France and Italy. Other EU Member States require farmers to keep buffer strips for nitrogen (Nitrate Directive) and for pesticides (Directive on the sustainable use of pesticides) if the farm is located in an NVZ. In Bulgaria on the other hand,

buffer strips are part of the GAEC on minimum land management. In Australia and South Africa buffer strips next to watercourses are a topic as well.

Due to GAEC 4 on avoiding the encroachment of unwanted vegetation, farmers in the EU have to mow unused arable land either every year or every second year or protect the agricultural land from the invasion of trees and bushes. Such a condition does not apply to Third Country farmers, where mowing of unused land is not regulated.

The retention of landscape features (GAEC 5) is implemented in all EU Member States as well as in Australia. Conversely, farmers in South Africa are allowed to remove landscape features.

GAEC 6 on minimum land management practices is implemented in some countries and regulates for Bulgaria for example, the establishment of a buffer strip.

B. FOOD SAFETY

The group "**Food Safety 6**" applies to Bulgaria, France, Italy, and Spain and contains two regulations which set specific procedures in matters of food safety and hygiene of foodstuffs. Similar requirements have to be fulfilled in Australia and South Africa.

C. NEW MEMBER STATE: BULGARIA

Table 4.86 indicates the steps that Bulgaria had to follow to align its legislation to EU standards.

Table 4.84 – Timetable of the implementation of selected EU directives in Bulgaria

Stage	Area	Legislation	Requirement
from January 2012*	Environment	Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources	SMR 4
from January 2014*	Environment	Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market	SMR 9
	Environment	Regulation (EC) No 1107/2009 of European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market	not among SMR
from 14th December 2011	Environment	Directive 2009/128/EC of the European Parliament and of Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides**	not among SMR
Campaign year 2010	Environment	GAEC1: Minimum soil cover	1.1
	Environment	GAEC2: Establishment of buffer strips	1.2
	Environment	GAEC4: Avoiding encroachment of unwanted vegetation	4.4
	Environment	GAEC5: Retention of landscape features	4.3
	Environment	GAEC6: Minimum land management	1.2
from January 2014*	Public health Animal health Plant health	Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety	SMR 11
		Regulation 852/2004***	SMR 11

** Some legislations might have been transposed into national law earlier, therefore becaming binding already earlier.*

*** Bulgaria joined the EU in 2007; the norm was published in 2009, thus it did not belong to the SMRs.*

**** mentioned in the footnote to SMR 11*

Bulgaria joined the European Union on 1 January 2007. As condition for accession, Bulgaria had to implement and enforce all current EU rules. Statutory management requirements (SMR) together with the GAECs constitute the so-called cross-compliance. Most of the EU rules analysed in this study are either SMRs or GAECs. In Bulgaria, the application of the SMR was optional until 31 December 2011 but became stepwise compulsory.

4.8.5.2. *Cost items list and potential impact at farm level by country*

In the following table, the cost items generated by the implementation of the legislation at farm level are listed. The list is based on the information collected via the experts and the panels carried out in each country to identify real additional costs faced by the farmers in order to comply with the legislation. The cross indicates in which country the cost item was identified as compliance cost, at least in one of the typical farms.

Table 4.85 – Comparison of legislative areas impacting cost of compliance in wine grape production

	legislation	item	BG	IT	FR	ES	AU	ZA
ENV	Plant protection products	pesticide storage		x	x	x	x	x
		washing area for sprayer	x	x	x	x		
		record keeping for pesticide application		x	x	x	x	x
	Sustainable use of pesticides	technical monitoring of sprayer			x	x		
		application of pesticides		x		x		x
		training for workers applying pesticides		x	x			x
	Water policy and regulation	reduced allowance to withdraw irrigation water during drought					x	
FS	standards of food safety and hygiene of foodstuffs	training of workers						x

Symbols: x = identified as compliance cost

4.8.6. Cost of compliance with selected legislation

The aim of the section is to analyse the cost of compliance with the legislations clustered as "the environment" and "food safety" for the typical farms studied. Only the figures referring to total costs are shown here.

In Table 4.86 and Table 4.87, which respectively refer to the environment and food safety, entries show the absolute values of the base scenario (with legislation) and the 'without' legislation scenario for each typical farm, as well as the absolute difference and the percentage change with respect to the base. The charts in Figure 4.41 and Figure 4.42 build upon the former values, visualising the total cost of compliance that farmers face due to environmental and food safety legislation, respectively.

Note that the Australian farm in the Riverlands bears the highest cost of compliance in the field of the environment. The reason behind this is that, in addition to the selected legislation on the shortlist, an Australian regulation concerning water usage for irrigation was considered in the analysis. Due to a persistent drought in 2010, the farm was restricted to only 62% of its licensed

water allocation. Therefore, the farm sustained an extra cost of approximately 4,060 €/ha to fully irrigate its land, which it would not have had to spend without the legislation (refer to footnote number 26). The AU20B is located in another water catchment area. Since it uses a different production, as well as irrigation system and thus less water, it was not affected by this regulation. Assuming that there was no drought in 2010 and farmers did not have to bear these additional expenses, the cost of compliance would be reduced from 296.70 €/t to only 1.28 €/t or from 41.32 % to only 0.3 % (see extra row AU22R*).

In France for instance, the farmers estimated the costs for a washing place at 25,000 €, while in Italy these costs were estimated much lower. Construction systems and washing facilities can be very different from country to country or depending on the farmers' preferences, thus cost differences can arise.

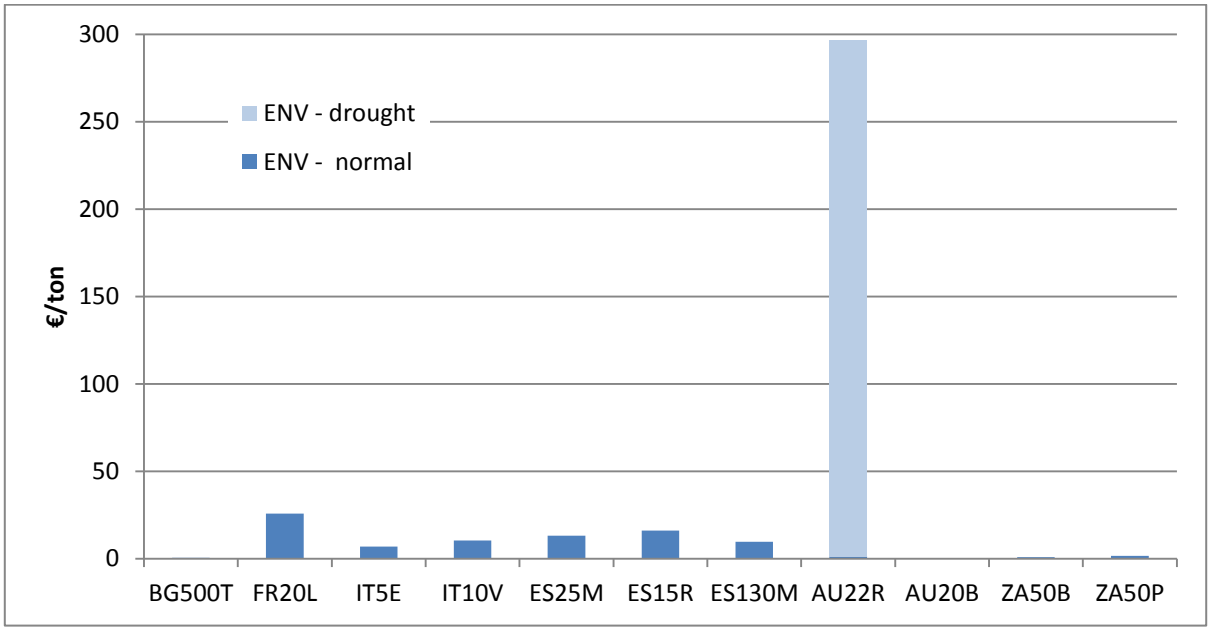
The Spanish farm ES15R would save 15 €/ton due to different reasons such as a simpler pesticide storage, continued use of old spraying equipment and less time and money spent on record keeping.

Table 4.86 – Costs of compliance with environment legislation for wine grapes in selected countries

environment		unit	base	without ENV	difference	% change
Bulgaria	BG500T	€/t	444.71	444.11	0.60	0.13
France	FR20L	€/t	629.99	604.16	25.84	4.10
Italy	IT5E	€/t	340.42	333.49	6.93	2.04
	IT10V	€/t	541.05	530.71	10.34	1.91
Spain	ES25M	€/t	324.94	311.76	13.18	4.06
	ES15R	€/t	493.23	477.14	16.09	3.26
	ES130M	€/t	288.59	278.93	9.66	3.35
Australia	AU22R	€/t	718.07	421.37	296.70	41.32
	*AU22R**	*€/t*	*422.65*	*421.37*	*1.28*	*0.30*
	AU20B	€/t	884.13	885.40	0.00	0.00
South Africa	ZA50B	€/t	300.73	299.85	0.88	0.29
	ZA50P	€/t	605.36	603.70	1.66	0.27

Own calculation; AU22R = production costs if in 2010 there had been no impact due to the drought and no need to buy additional,expensive water rights*

Figure 4.41 – Cost of compliance with environment legislation for wine grapes in selected countries



Own calculation

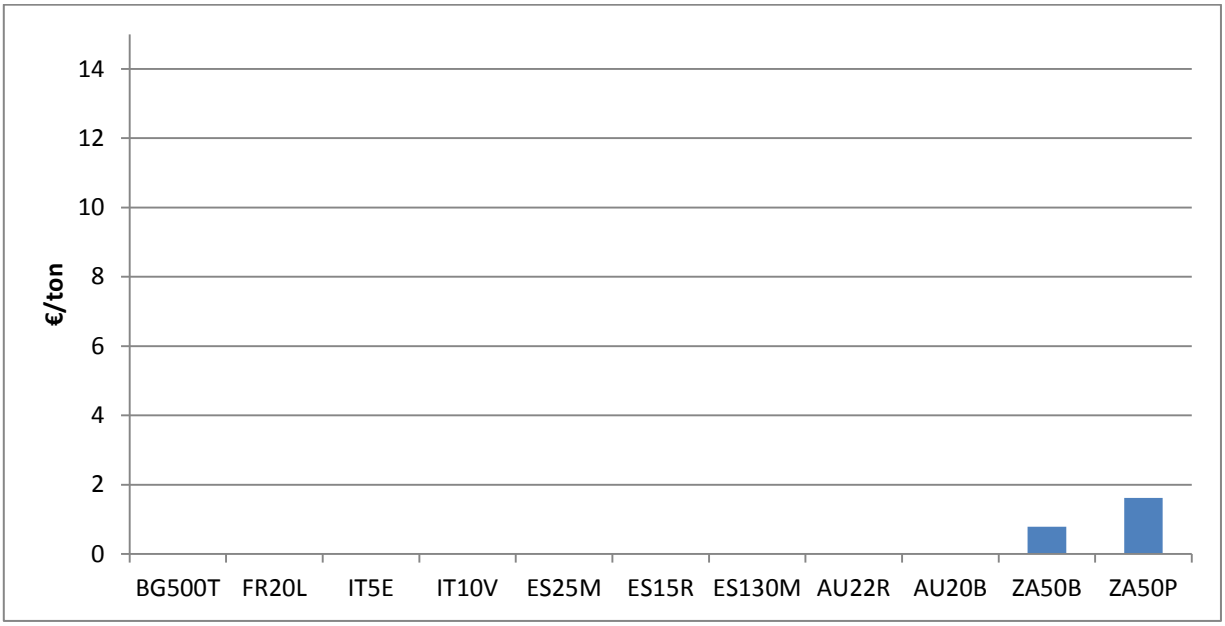
Table 4.87 and Figure 4.42 illustrate the cost of compliance arising from the selected food safety legislations in the wine grape case study. Note that only the two South African typical farms are experiencing a cost of compliance with this group of regulations. Specifically, these farms register a cost of compliance of 0.80 €/ton and 1.60 €/ton respectively, deriving from training measures for staff members, which otherwise would not be accomplished.

Table 4.87 – Cost of compliance with food safety legislation for wine grapes in selected countries

food safety		unit	base	without FS	difference	% change
Bulgaria	BG500T	€/t	444.71	444.71	0.00	0.00
France	FR20L	€/t	629.99	629.99	0.00	0.00
Italy	IT5E	€/t	340.42	340.42	0.00	0.00
	IT10V	€/t	541.05	541.05	0.00	0.00
Spain	ES25M	€/t	324.94	324.94	0.00	0.00
	ES15R	€/t	493.23	493.23	0.00	0.00
	ES130M	€/t	288.59	288.59	0.00	0.00
Australia	AU22R	€/t	718.07	718.07	0.00	0.00
	*AU22R**	*€/t*	*422.65*	*422.65*	*0.00*	*0.00*
	AU20B	€/t	884.13	884.13	0.00	0.00
South Africa	ZA50B	€/t	300.73	299.94	0.79	0.26
	ZA50P	€/t	605.36	603.73	1.62	0.27

Own calculation; AU22R = production costs if in 2010 there had been no impact of drought and no need to buy additiona, expensive water rights*

Figure 4.42 – Cost of compliance with food safety legislation for wine grapes in selected countries



Own calculation

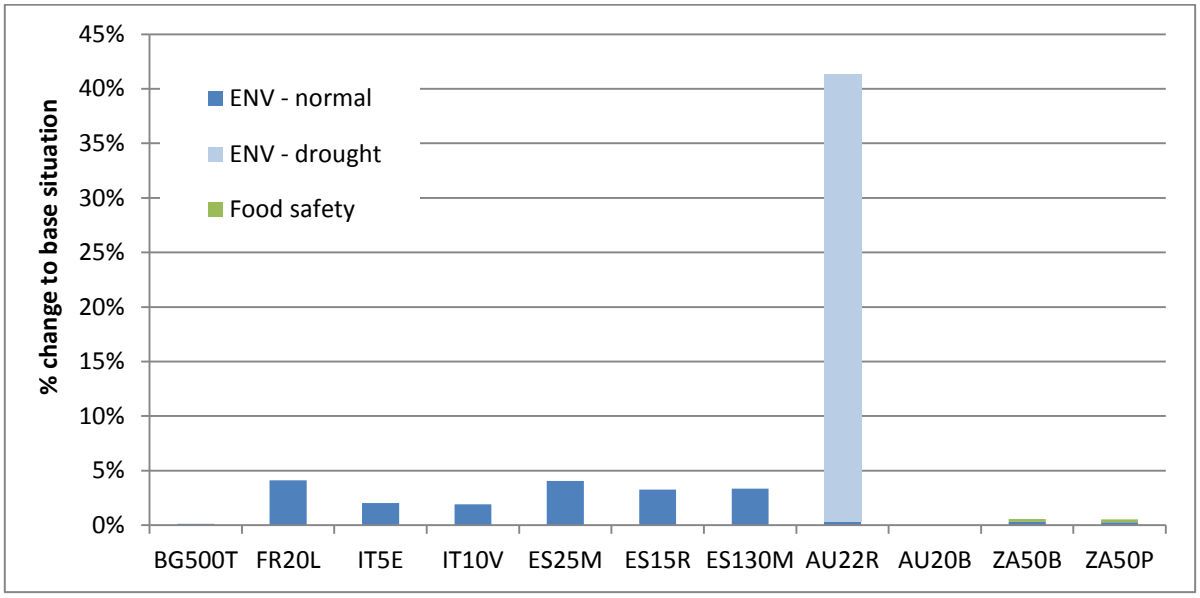
In general, the analysis takes into account the process of wine grape production only up to grape harvesting, and therefore quality measures and similar operations taking place at a later processing stage are not considered. Furthermore, participants of group discussions reported that issues regarding traceability, food hygiene and safety are common, modern business practices these days and would be followed even without compulsory norms. Consequently, none of the other farms reported costs in this regard.

Table 4.88 – Comparison of percentage change to base by normative area: wine grapes

	ENV normal	ENV drought	Food safety	Total
BG500T	0.13	0	0.00	0.13
FR20L	4.10	0	0.00	4.10
IT5E	2.04	0	0.00	2.04
IT10V	1.91	0	0.00	1.91
ES25M	4.06	0	0.00	4.06
ES15R	3.26	0	0.00	3.26
ES130M	3.35	0	0.00	3.35
AU22R	0.30	41.02	0.00	41.32
AU20B	0.00	0	0.00	0.00
ZA50B	0.29	0	0.26	0.56
ZA50P	0.27	0	0.27	0.54

Own calculation

Figure 4.43 – Comparison of percentage change to base by normative area: wine grapes



Own calculation

Table 4.88 and Figure 4.43 offer a broader comparison among the environment and food safety areas in terms of percentage change with respect to the base situation.

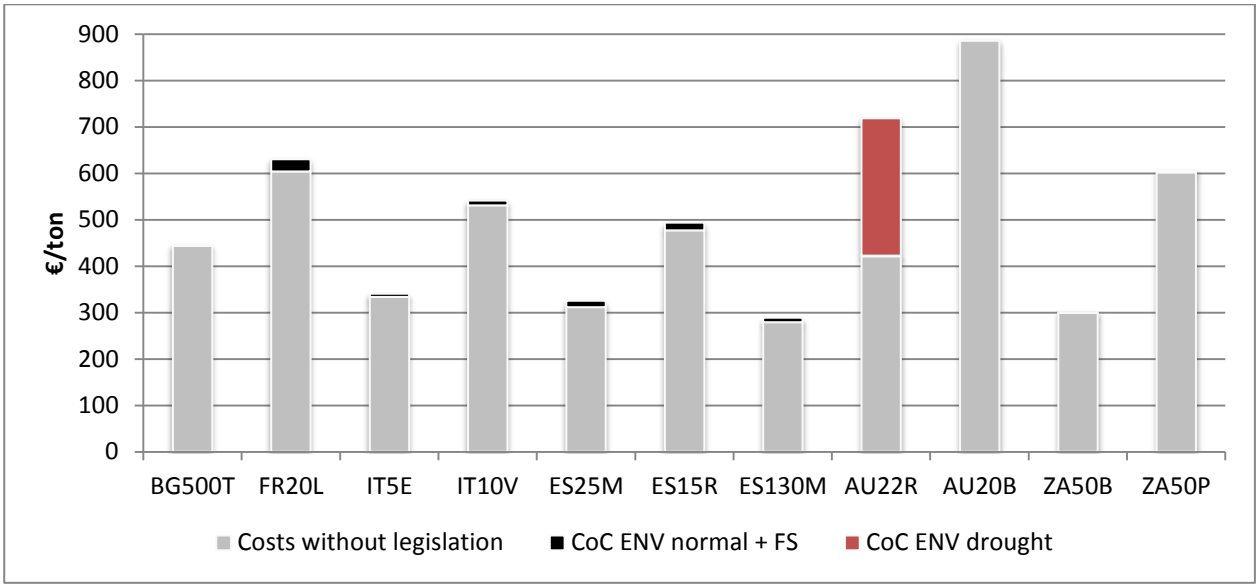
In the previous case studies, the environmental section was further separated into its single components. The same approach would lead to distinguishing the Nitrate Directive from the remaining environmental directives and regulations. However, the Nitrate Directive was not relevant for the six countries studied through the typical wine farms: even though some measures might be implemented, they do not cause any cost at farm level. Generally, wine grapes are fertilized only to a small extent, meaning that the maximum limits are usually complied with. Besides, the record keeping procedure for fertilizer and pesticide applications would be performed even without a normative requirement, in reason of private quality and certification schemes the farms are participating in. However, due to the importance of the environmental legislation in Australia regarding restrictive use of irrigation water during a drought situation, the impact of this regulation (ENV drought) is displayed separately from to the remaining environmental laws (ENV normal). Therefore, the table shows two columns to illustrate the environment.

Note how the absence of the norms on environment protection and food safety would benefit mainly Australian farms in the Riverlands, France, Spain and Italy, while there would hardly be any effect in Bulgaria and South Africa. Compliance costs range from 0.0 % to around 4 % (41 %), and they are mainly associated with environmental legislation.

The figure below compares the total cost with and without legislation for the typical wine grape farms. The figure further illustrates that the competitive position of the various typical farms, except

Australia during drought, would not change if compliance with environmental and food safety regulations was not necessary.

Figure 4.44 – Production cost for wine grapes and cost of compliance of selected legislations, 2010



Own calculation

In general, the compliance costs of the analysed farms are relatively low and do not exceed 4.1 % (41.3 %, Australia during drought) of the total costs.. The reason for the low cost impact is that investments such as pesticide storage, a washing area, or spraying equipment are depreciated over 10-20 years. Therefore, the impact on a per ton basis in one particular year is rather small. Another reason for the low compliance cost is that even without some of the regulations, farmers would not change their management practices. They perceive them as good agricultural practices and see the benefits of these practices. For instance, the participants of the Bulgarian focus group saw a high value in training courses for pesticides as this increases worker safety and helps save products. Thus, they would also attend these courses without the directive on sustainable use of pesticides. In addition issues regarding traceability, food hygiene and safety are common, modern business practices these days and would be followed even without compulsory norms.

For most of the European farms considered, the compliance costs are very homogenous and vary in the range of 1.9 to 4.1 %. Just the Bulgarian farm has lower compliance costs of only 0.13 %. There are a number of reasons for this. First of all, the Bulgarian and also one Spanish farm profit from economies of scale. While all other farms comprise between 5 and 50 ha of vineyards, the Bulgarian farm cultivates 500 and the mentioned Spanish farm 130 ha of vineyards. The Bulgarian farm purchases pesticides as they are used on farm and therefore does not have to construct any special pesticide storage which causes cost of compliance in all other farms analysed. By using EU

subsidies, the machinery of the Bulgarian farm is very modern and thus complies with the respective regulations. Therefore, the farm does not incur compliance costs in order to modernize its machinery in contrast to the typical farms in France and Spain.

The production costs per ton of wine grapes differ much more between the farms than the compliance costs. The differences in production costs are mainly driven by the land costs, which vary considerably between the farms and even within countries. While the Australian farm in the Riverlands shows the lowest land prices with only 10 €/t (138 €/ha), the second Australian farm in the Barossa valley shows the highest land costs, amounting to 150 €/t. On a per hectare basis, the Italian farms realize the highest costs with 1,350 – 1,500 €/ha. In the Riverlands, low land prices coincide with low farm gate prices and in Barossa the opposite; there, high land costs goes hand in hand with high revenues.

Also the labour costs differ considerably between the production systems and countries. On the six farms which harvest the grapes entirely with machines, labour costs range from 67 to 193 €/t. The farms that use a mixture of machine and hand harvest had higher labour inputs and thus higher labour costs of 73 up to 325 €/t. In addition some differences can be explained by differences in wage rates. Wages on the Bulgarian farm were calculated with only 1.5 €/h while wages on the Australian Barossa farm reach up to 13.4 €/ha.

Another driver for differences in production costs are the irrigation costs which are zero on most European farms and reach up to 320 €/t on one Australian farm during the drought situation (see Table 4.5984). Assuming a “normal year”- meaning no impact due to the drought and farmers not having to purchase additional, expensive water rights - the variable costs for irrigation would drop to 36 €/t on that farm.

5. Conclusions

The results of this study show that there is a wide range of costs of compliance with legislation in the field of animal welfare, environment and food safety with regard to the different products and countries. In this conclusive chapter, an effort will be made to group the results according to animal production, crop production and legislation categories (the environment, animal welfare and food safety). It should be immediately stressed here, that the methodology used in this study does not allow to extrapolate the results to all farms of a EU Member State or of a third country. The study can only provide hints, but it is not possible to draw general conclusions on the EU farmers' situation.

On the typical farms specialised in animal production, the food safety legislation creates higher compliance costs than on typical farms specialised in crop production. Specifically, various food scandals have affected animal production which explain the strict corpus of legislation in this field. Food safety regulations structurally affect the non-factor and labour costs of farms. Legislation in the field of the environment and animal welfare, instead, primarily affects capital costs, as such legislation often requires a production system change on the farms. Farmers may have recombined production factors and may have found a new production optimum following the entry into force of EU legislation concerning environment, animal welfare and food safety. Therefore, farmers may have reduced the initial cost impact of the legislation.

In an attempt to increase the environmental sustainability of agriculture, the EU has issued a set of regulations which creates costs to farmers but also generates awareness, prompting farmers to make better use of their resources. This increased awareness may have further improved the management techniques, which may mitigate the increase of costs related to compliance with environmental legislation.

As might be expected, the typical pig and broiler farms are most affected by legislation in the three policy fields. The farmers' compliance costs for these farms oscillate on average between 5 and 10% of production costs against an average range of 2-3% for dairy, beef and sheep meat. Environmental legislation may create the tendency to move pig and poultry production to more extensive areas. However, after analysing the European geographical distribution of these two intensive animal production systems, one notes that the economies of agglomeration are stronger than the reduction of costs resulting from moving pig and poultry farms to other areas, e.g. cereal producing areas. In the specialized production areas of EU pig and broiler production, farmers comply with environmental standards by introducing new technologies which may cause the closure

of small farms which cannot afford these investments. At the same time this creates renewed, environmental sustainable production units which are much more respectful of animal welfare. Regardless the introduction of strict standards, the EU self-sufficiency rate of pig and broiler production did not decline.

The typical farms producing milk, beef and sheep meat definitively sustain lower compliance costs with the legislation under scrutiny. The animal density on these farms is lower than in pig and broiler farms, as the production systems are more 'land based' due to the need of the production of roughage. These farms cause less environmental problems and the housing systems are more in line with animal welfare requirements. The same can be said for these types of animal farms in third countries where stocking rates are often lower than in the EU.

An exception for the different food safety legislations must be made for the use of – in the EU banned - beta agonists and ractopamine in beef and pig production respectively. Their use increases the competitive position of the U.S. on third countries markets in which the EU is also operating, whereas the EU ban creates high costs of compliance when US meat is exported to the EU.

In most cases, the typical crop farms (wheat, apples and wine grapes) are less affected by legislation than animal production farms. Their compliance costs are in the range of between 1 and 3.5%. The crop farms are facing compliance costs primarily with environmental legislation. Here food safety regulations have a very limited impact on production costs. Within the group of environmental legislation, the nitrate directive and the plant protection directive exert the greatest effect on production costs. Good Agricultural Environmental Conditions (GAECs) in this context, have a minor impact on costs. In the third countries investigated, legislation in the field of the environment and food safety poses fewer restrictions on wheat and wine grapes than in the EU. However, for apples, the producers in Chile and South Africa face similar costs of compliance, especially when they export their products to the EU. The reason for this is that these producers shall comply with private standards in order to access to export markets and domestic multiple retailers in the EU. These standards are similar to the EU legal requirements.

More in general, on average, production cost differences for wheat and wine grapes between the EU and the third countries investigated either do not exist or are less important than those applying to animal products. German and Hungarian wheat farms have similar production costs as the farms in the Ukraine and Canada. The production costs differences for wine grapes are also negligible. However, significant differences in production costs are noted for apples, where the producers of Chile and South Africa are able to produce at 50% of the EU production costs. This is due mainly to

lower labour costs and a higher productivity per hectare[30] in comparison to in particular the German typical apple farms.

5.1. Cost of compliance with Environmental legislation

The environmental legislation generating cost of compliance at farm level includes: the **Nitrate Directive**, which deals with slurry management in a broader sense; the **IPPC Directive** (integrated pollution prevention control), which targets the emission of pollutants from animal husbandry; the **Directive on plant protection products,** which regulates the trade and use of plant protection substances and the procedures necessary to obtain authorizations for new pesticides; and the **Directive on the sustainable use of pesticides,** which aims at establishing closer monitoring and better training for pesticide application in the European Union. A group of **GAECs** (Good Agriculture and Environmental Conditions) targeting soil and landscape protection, crop rotations, buffer strip maintenance, and avoiding encroachment of unwanted vegetation was included in the selection as well.

The above-mentioned legislation does not generate the same cost of compliance for all the sectors analysed in this study. For an homogeneous analysis results will be discussed clustering the eight sectors into three groups of uniform legislation:

- **Dairy, Beef meat** and **Sheep meat** are mainly affected by the Nitrate Directive;
- **Pork meat** and **Broiler meat** shall comply with both the Nitrate Directive and the IPPC Directive;
- **Wheat, Apples** and **Wine grapes** are affected by the Nitrate Directive, the Directive on Plant protection products, the Directive on Sustainable use of pesticides and the GAECs.

In the first group (dairy, beef meat and sheep meat), the costs and benefits of compliance with the Nitrate Directive range between 0% and 2.1% of total costs among typical farms in the countries investigated. Differences exist among the sectors.

Dairy - The Nitrate Directive (ENV) affects farm management of the dairy farms in nearly each EU Member State. Within the EU, the upper limit of 170 kg organic N per ha and a minimum storage

[30] In Italy, Chile and South Africa apple farms are all irrigated and use more productive apple varieties

capacity cause the main costs, but also benefits in terms of increased manure N efficiency. Water and air quality have improved, due to decreased nitrates losses to ground and surface waters and a reduction of ammonia/nitrous oxide emissions to the air. The focus on slurry nutrient content and on fertilizing plans led to a reduction in the amount of chemical fertiliser purchased by dairy farmers in all Member States, without a relevant impact on crop yields, as dairy farmers have become more aware of the overuse of chemical fertilisers.

Between the EU typical farms, there is a wide range of costs of compliance ranging from 0.04% in Germany to 1.6% in the Netherlands. For most farms, the costs were around 0.2% and can be attributed mainly to additional storage facilities. Due to higher the stocking rate of dairy farms in the Netherlands, costs were higher (1.6%), as excess slurry above the limit of 170 kg N has to be transported outside the farm and often to other areas. Large volumes, transport distance, and the stocking rate of the farms involved in the process are the cost drivers. The Netherlands has been granted a derogation to 250 kg N/ha/year to farms with at least 70% of grassland, as permanent grassland is able to absorb up to 250 kg N/ha/year. As a result, dairy farmers in this country need to transport less manure outside the farms, which reduce the costs of compliance.

In Ireland, the implementation of the Nitrate Directive has brought to a better appreciation of the nutrient (Nitrogen, Phosphorus) content of organic manure[31]. This has led to a better recovery of N from organic sources and a reduced application of mineral N. The calculated cost of compliance on the typical farms was about 0.2-0.3% of the total costs.

In Poland, after the accession to the European Union, all stakeholders involved – farmers, the dairy industry, and also the government – expected the Nitrate Directive to come into full force within a few years. Therefore, investments in slurry storage were made ahead of time in order to prepare the sector well in advance by the time when the Nitrate Directive will be fully implemented. In 2010 only 2% of the territory was designated as NVZ[32]. This is an example of new legislation, still to be implemented, which has already been implemented by the industry concerned, e.g. investments in slurry storage. The cost of compliance in Poland was limited to 0.2-0.6%.

Argentina and New Zealand both mainly practice grazing systems for dairy cows. Only New Zealand has regulations regarding the protection of streams, rivers and groundwater from nitrogen pollution and the costs arising from compliance with this legislation are comparable with those for EU-farms and are in the lower cost range (0.2%).

[31] The better application and the choice of the correct period of spreading organic manure, which has been stimulated by the Nitrate Directive, has caused a reduction of mineral Nitrogen and Phosphorus. In this way the N and P present in organic manure has been better exploited.

[32] Nitrate Vulnerable Zone (NVZ) is an area in which the Action Programme is implemented related to the Nitrate Directive

Beef meat - The Nitrate Directive affects the beef farms in nearly all EU Member States. The impact ranges between 0.1 and 2.1% of the total typical farm's cost of production. The impact is higher in Italy due to the high animal stocking rate in the typical farms selected in the beef producing regions. Therefore, in order to comply with this legislation, the farms have to pay for a permit to spread manure on additional land and transport excess manure to this land. The lowest cost effect can be found in France (0.1%). In this case, the typical farm is not inside the Nitrate Vulnerable Zone which is a characteristic of most French beef farms. In the UK, beef farmers have invested in effluent tanks because of the Nitrate Directive. In the UK, cost of compliance has been calculated at 0.2-0.3% of the total costs of production.

In the third countries investigated, Brazilian farms are affected by an environmental legislation similar to the EU Nitrate Directive. Its impact across the typical farms ranges from 0.3% to 1.3% of the total production costs. The costs of compliance stem from the legislation for Permanent Preservation Areas, important for the protection of the environment and water resources. Obligations in these areas are the maintenance of protective strips along watercourses, which depend on the width of the rivers.

No compliance costs with environmental norms were identified for the Argentinian typical farms.

Sheep meat - Compliance costs have been identified in all countries covered by this study. The costs calculated are quite homogeneous among EU Member States and third countries investigated, ranging from 0.2 to 0.3% in France and the UK, to 0.4 to 0.9% in Australia and New Zealand. The compliance costs in Australia stem from the Australian environmental legislation, which covers issues related to storage, handling and documentation of dangerous chemicals, as well as wild animals control. These regulations are specific to Australia and cause costs which affect the majority of the sheep farms in this country. In New Zealand, the costs of compliance are related to control of the quality of water.

In the second group (pork meat and broiler meat), farms are affected by both the Nitrate Directive and the IPPC Directive. The costs and benefits balance ranges between 0% and 4.7% of total costs among the typical farms of the countries investigated. Differences exist among these two sectors.

Pork meat - Three out of four EU Member States investigated in this study are affected by environmental legislation. For the typical farms concerned, cost of compliance is a combination of

meeting the requirements of the Nitrate Directive and the IPPC Directive. Costs of compliance have been calculated to be 4.7% in Germany, 0.7% in the Netherlands and 2.2% of the total production costs for Danish typical farms. No cost in Denmark was identified in relation to the IPPC based on EU requirements (BREF 2003)[33].

Nevertheless, there is a cost effect due to the fact that Denmark has chosen to impose a series of optional techniques listed in the BREF, such as cooling slurry canals and air cleaning with acid and biological systems.

The German and Dutch pig farms had to increase their manure storage facilities from a capacity for 4.5 months up to 6 months. They also have to transport excess manure to other farms. A benefit of the German pig farmers is that they reduce the purchase of Nitrogen fertiliser as they now are able to make better use of their own manure as a longer storage period increases the Nitrogen efficiency of manure. The IPPC Directive has no direct bearing on German pig farms. When the EU requirements are taken into account, the IPPC Directive plan does not have any direct consequences for Dutch pig farmers, as the requirements listed in the BREF of 2003 are line with the best practices pig farmers already adopt anyhow. However, the national interpretation of this Directive generates farmers' costs related to investments in ammonia filtering technology.

Polish typical pig farmers are not affected by environmental legislation because the Nitrate Vulnerable Zones in Poland comprise only 2% of the Utilized Agricultural Area. Besides, the size of the pig farms is rather small and therefore, these farms are not subject to the requirements of the IPPC Directive.

Environmental legislation has a minor impact in third countries where equivalent legislation accounts for just 0.1% for the US typical farm and 0.3% for the Brazilian farm. In Brazil, pig farms must have a storage capacity for manure of at least 120 days. Like most of their colleagues in the EU, Brazilian pig farmers also have to transport excess manure to other farms.

In Iowa, the only marginal cost encountered is the "paperwork" burden associated with compliance with the Clean Water Act for large CAFOs[34]. According to the panel of experts in Iowa, as fertilizer costs have grown, the benefits associated with the correct treatment of manure as specified in the regulations have also increased.

[33] Best available tecniques REFerence document (BREF)

[34] CAFO = Concentrated Animal Feeding Operation defined by the Clean Water Act

Broiler meat - Costs of compliance have been identified in two out of three EU Member States investigated in this study. The costs range between 0.4% and 2.3% respectively in France and in Italy, with no compliance costs in Germany. These costs are generated by the typical farms' compliance with the Nitrate Directive and the IPPC Directive.

In France the Nitrate Directive requires the broiler farmer to have a Nitrogen abatement plant and to use the manure as a fertilizer. The Nitrate Directive has strongly increased the awareness of broiler farmers of the value of manure. Thus as they reduced significantly the purchase of mineral fertiliser, the costs of manure disposal in NVZs is being reduced. For a typical German farm, the environmental limits imposed by the legislation do not represent any additional cost factor. These farms own enough land to dispose of the manure produced by the broiler flock. The Italian broiler typical farm is however highly affected by the Nitrate Directive. They have to transport manure to other farms, invest in a Nitrogen abatement plant, use low protein feed enriched with essential amino acids and reduce the number of broilers' densities. The improved manure Nitrogen utilisation leads to a reduction in purchase of mineral N-fertiliser. This is considered to be a relevant benefit from the Nitrate Directive implementation.

IPPC requirements to reduce emissions do not cause extra costs on the typical broiler farms in Germany, France and Italy, because farmers declare that the BATs (IPPC), such as the reduction of the use of energy and water, match their common practices and that they would take the same actions anyway, regardless of this directive. Due to IPPC requirements, German broiler farms use also, diet supplementation with synthetic essential amino-acids and phytase. This practise allows a reduction of protein (soybean) input and mineral Phosphorus.

In third countries investigated such as Thailand and Brazil, there is less demanding legislation and therefore negligible cost of compliance for the typical farms. The limitation on spreading enforced in Brazil is the only regulation that can be considered similar to the Nitrate Directive. Brazilian producers are nonetheless subject to the requirement of environmental licensing, which recalls the objectives of the IPPC Directive. Cost of compliance in this case has been calculated at 0.03% of the total costs.

This third group includes the sectors (wheat, apples and wine grapes) mainly affected by the Nitrate Directive, the Directive on Plant protection products, the Directive on Sustainable use of pesticides, and the GAECs. The costs and benefits balance ranges between 0% and 4.1% of the total costs in the countries investigated, though differences exist between the different sectors.

Wheat - Within the EU, the highest absolute impact is observed for the Danish farms (3.4%), followed by the typical UK farm with 3.2%. In Danish farms due to the Nitrate Directive less nitrogen can be spread on wheat, consequently the yield per hectare is impacted and is lower. So the costs level expressed per ton of wheat is higher. Also with the plant protection regulations, typical Danish farms have to use more complex storage facilities for pesticides and dedicated washing areas for the sprayers.

In Germany, the farmers use extra labour time for the documentation of the nutrient balance of the Nitrate Directive. Moreover a farm gate nutrient balance is set up and buffer strips are put in place.

The plant protection regulations oblige typical farms in Germany to adopt frost resistant and lockable pesticide storages.

Regarding GAECs, farmers have set up humus balances with standards for crop rotation, which generate extra labour time. In Hungary, extra labour time is dedicated to documentation activities related to the requirements of the Nitrate Directive while buffer strips have been put in place which created a limited reduction of the overall yield of wheat. The plant protection regulations generated farmers' investments in washing-equipment for sprayers. The GAEC on buffer stripes has not been implemented in Hungary in 2010. Other GAECs do not result in any cost increase in this country.

In the UK, labour time is dedicated to the documentation requirements of the nitrate action programme. Besides, an investment in higher sprayer capacity was necessary to reduce the refilling time for liquid fertilizer, and also a dedicated storage room for pesticides. Moreover, high pressure washers have been installed on the sprayers, and inspection is being carried out on a regular basis.

In the UK, GAECs induced farmers to create buffer strips on the edge of a slope or next to a hedgerow. GAECs in the UK also include public rights of way, thus farmers are responsible for maintaining footpaths, bridleways, and restricted byways if they cross their fields.

Conversely, the typical farms of the third countries investigated reported a negligible impact in Canada and a small impact of up to 0.5% on Ukrainian typical farms. In Ukraine, with regards to plant protection, the investments have been done in storage rooms for plant protection products. As in the EU, buffer strips have to be established on wheat farms.

Apples - Environmental legislation has an impact in all countries investigated in this study. In particular, the highest impact was calculated for the typical farms in Germany and Italy, with a cost range of between 0.8% and 3% of total production costs in Germany, while in Italy the impact ranges between 1.4-1.9% of the total production costs.

Cost of compliance with environmental legislation calculated in Chile ranges between 0.1% and 2.9%, while in South Africa farmers' compliance costs range from 0.3% to 2.5%.

Nevertheless, it should be noted that in case of export to the EU, fruit producers of South Africa and Chile shall comply with private standard certificates such as Global Gap or other retailer's certification schemes as a basic condition for accessing export markets regardless of the export destination. Even for premium priced marketing channels on national markets (e.g. supermarkets), such certification is necessary today. The private certification schemes are stricter than the legislation in many aspects, particularly for pesticide use, food safety and worker welfare.

In all countries, cost of compliance is concerned with the sustainable use of pesticides. The requirements for pesticide storage rooms were identified as a cost item in all cases. Also, regulations for spraying equipment were mentioned as a cost factor on typical farms in Germany and Italy, but these costs differ apparently in relation to the farm size. A cost effect was also found for the buffer strips, where pesticides cannot be applied along water courses. This affects the smaller German farms, where fewer apples could be harvested.

The major costs of compliance for the Italian apple farms are due to the limited choice of plant protection products which are more costly than those products that were previously allowed.

The Nitrate Directive has no effect on apple production in Italy, Germany or Chile. This is due to the application of well-balanced, sophisticated fertilization plans for orchard management and fruit quality. As the equivalent legislation in South Africa poses limits on the use of nitrogen, the major costs of compliance are caused by lower yields which generate higher costs per kg of fruit.

Wine grapes - Environmental legislation affects the wine grape producers of countries selected for this case study. In particular, the estimated compliance costs on the typical farms in France, Italy, Spain and Bulgaria range from 0.1% in Bulgaria to 4.1% in France. Cost of compliance with environmental legislation calculated in South Africa has been estimated at 0.3%, while in Australia it was calculated at 0.2% under normal weather conditions.

Wine grapes do not require much fertilizer, except during the phase when the grape vines are planted. Fertilizer might even be counter-productive since it increases the vegetative production which hinders grape development.

Regarding the Directives on Plant protection products and on the Sustainable use of pesticides, a number of requirements have an impact on the costs of production. Farms need to keep pesticides in storage facilities and have to dispose of adequate washing areas. Also pesticide record keeping is demanding labour time for farmers.

In Bulgaria, the cleaning of sprayers in a nearby car wash are costs related to compliance with pesticide legislation. Modern machinery used for pesticide application has a cabin and air

conditioning which protects the workers from contamination. Thus, farmers have protective clothing, which are to be considered as an additional cost due to the legislation.
In France, Italy and Spain, wine grape farmers have pesticide storage facilities. Moreover, farmers devote a special area to spraying equipment cleaning. The pesticide application equipment is checked by a technical specialist and not only by the farms' own personnel. Record keeping regarding fertilizer and pesticide application requires labour time to carry out this work properly. Finally, new regulations require the operators to attend a training course. Certainly these compliance costs may lead to direct benefits for the agricultural workers in relation to human health.
In Australia and South Africa, wine grape farmers have invested in pesticide storage facilities as well and record keeping of pesticide application is now routinely done. They have to renew certificates for workers applying pesticides and also in these two countries only selected numbers of pesticides is allowed to be used.

5.2. Cost of compliance with Animal Welfare legislation

The animal welfare legislation identified as having cost of compliance effects at farm level includes: the Directive on Protection of animals kept for farming purposes, the Directive on the Protection of calves, the Directive on Protection of pigs and the Directive on chickens kept for meat production. Obviously, the above-mentioned legislation generates cost of compliance as well as benefits only in animal production sectors: dairy, beef, sheep, pigs and broilers.
In general, the costs of compliance with animal welfare legislation in the different sectors and countries vary between 1.1% for Italian broiler farms and 3.5% for Polish pig farms. The negative impact means that, in that specific case, compliance with the animal welfare legislation leads to higher benefits and to a cost reduction.

Dairy - The directive regarding animal welfare lays down standards for the protection of calves. Germany was the only country where farmers had to adjust their calf boxes and houses to the new standard required, thus facing some compliance costs. The impact on German farms ranges between 0.3% and 0.8% of the total costs. In the other EU Member States, these standards were already being met for a long time. For example, in Ireland the regulation on the protection of calves did not have any impact as historically Irish dairy farms group house calves in facilities with adequate space and infrastructure already compliant with the directive. They also adopt the spring calving system. In the Netherlands and in Finland, calf management follows high standards, and the

legislation does not impose additional burdens on farmers. In Poland, the norms regarding the protection of calves were enforced in January 2013 and therefore the directive did not cause costs of compliance in the reference year 2010.
In Argentina and New Zealand, young calves are traditionally housed in groups and turned out to pasture soon after birth. This practice is also required by the Animal Welfare Act in New Zealand.

Beef - No specific space allowances are prescribed in the EU welfare legislation for beef cattle. Considering the typical beef producer´s handling strategies and the characteristics of typical farm facilities, the animal welfare legislation in France and Italy has no impact on actual production costs. In the third countries investigated, Argentinian and Brazilian animal welfare legislation have no impact on actual production costs for much the same reasons.

Sheep - French and UK sheep farms do not face any costs related to animal welfare legislation and does not affect the production costs. Also in Australia and New Zealand, animal welfare legislation has no impact on actual production costs.

Pigs - Animal welfare requirements in this sector are a prerogative of the EU, with a focus on the directive on Protection of pigs. This Directive concerns:

- Minimum space allowances for sows, gilts and fattening pigs;
- Group housing of sows and gilts from the fifth week after insemination;
- Free access to manipulable material;
- Prohibition of full slatted floors for sows and gilts

Cost of compliance is registered in all Member States, with Poland experiencing the highest compliance costs (3.5%). In this case, the cost increase is particularly significant as the pig farms are relatively small compared to the common farm size in Denmark, Germany and the Netherlands.
The requirements of the directive on the Protection of Pigs concerning the minimum space allowance for sows and group housing were determined in Germany in 2006 by means of national regulation for animal welfare. However, such requirements were not met by all farms immediately, and a transition period until 2013 was granted for stables built before 2006. In Germany, the requirements of the directive on the Protection of Pigs increase the production costs by 2.18% of slaughter weight/total cost.
In the Netherlands, due to national requirements stricter than those laid down in the EU Directive for fatteners, gilts and piglets, pigs have already a larger surface available than that required by EU legislation. This means that for these specific requirements of the directive, the EU legislation does

not create extra compliance costs for Dutch pig farmers. However, for pregnant sows, most pig farmers face compliance costs, because they had to adapt their stables and invest in a group feeding system and floor.
The typical Danish pig farmer faces costs related to the group housing of pigs, a higher fibre content in the diet of sows and the use of manipulable materials for growing pigs.
Brazil and the USA do not have relevant equivalent animal welfare legislation for pigs and therefore do not have any costs of compliance.

Broilers - Compliance costs in this sector have been analysed based on the Directive on chickens for meat production. This EU legislation creates a very different impact in the three EU Member States analysed. The compliance cost ranges between -1.1% in Italy to 1.45% in Germany.
In Italy, for example, the typical broiler farm will, for climatic reasons (hot summers), increase the broilers' stocking density from 33 kg/m^2 up to 39 kg/m^2 by means of extra ventilation technology and cooling facilities. By adopting this strategy, the increased production per square metre will compensate the extra costs related to the necessary investments and as a result the production costs in this country will decline slightly by 1.1% of the total costs.
In Germany, investments have to be made for the construction of larger windows in order to create more light in the stables and the stocking density has to be decreased. This generates extra costs for the broiler producers ranging between 0.6% in the north and up to 1.4% of total costs in the south of Germany.
In France, the cost impact differs between regions. In Brittany the directive is neither a constraint nor an extra cost as the density of broilers on this typical farm is in line with the Directive. However the Welfare Directive is an extra cost for the typical farm in the Pays de la Loire, because the density of broilers (45 kg/m^2) used to be much higher than the density allowed by the Directive. On this typical farm therefore the fixed costs increase.
Animal welfare is not a relevant legislative issue in Brazil or Thailand, as in both countries the stocking densities are rather low due to climatic reasons and well below the 33 kg/m^2 mentioned in the EU Directive. In these circumstances, a higher density would be economically inconvenient as mortality would rise significantly.

5.3. Cost of compliance with Food Safety and Animal Health legislation

The food safety and animal health legislation identified as having cost of compliance effects at farm level includes 26 various directives and regulations. To simplify their description, they have been classified into six different groups (FS1 to FS6). Each group targets a similar type of legislation:

- FS1 describes the regulations feed mills have to follow when producing, storing and selling animal feed.
- FS2 deals with legislation preventing outbreaks of serious and highly contagious diseases.
- FS3 bans feeding animals substances with anabolic effects.
- FS4 includes legislation dealing with the identification and registration of animals.
- FS5 deals with the prevention of TSE (Transmissible Spongiform Encephalopathy), foot-and-mouth disease and bluetongue.
- FS6 comprises legislation regarding food law and traceability of food and hygiene rules for food of animal origin.

Food safety and animal health legislation applies to all different sectors investigated in this study. The legislation related to FS1 to FS5 deals with animal production sectors while FS6 is particularly relevant for crop production.

The costs of compliance with food safety legislation range from 0.0% to 4.5% of the total production costs. In some sectors and countries, the negligible impact means either that the legislation is fully implemented as a common practice and there would be no difference if the legislation was not in place, or the legislation is more stringent in the processing phase rather than in the primary production phase. In all other cases, there is a combination of different types of food safety legislation resulting in cost of compliance.

Dairy - Various types of regulations and directives belonging to this food safety category influence the dairy farms. Compliance costs in the investigated EU Member States oscillate between 0.2% and 1.5%

In Finland, cost of compliance related to animal health legislation aiming to prevent TSE, foot-and-mouth disease and bluetongue are not a major issue, as there is a strict control of zoonotic diseases by means of frequent checks on farms by veterinarians. Cattle identification and registration became

more elaborate than it used to be due to the directive and regulation. In Finland, many of the hygienic rules were followed anyway, as dairy processors also demanded high hygienic standards.

In Germany, cost of compliance with food safety legislation is a result of the implementation of different legislations. Compound feeds have become more expensive (1 to 5%) due to the EU directives and regulations the feed industry has to comply with, depending on the ingredients and production processes of the respective compound feed. Regarding the legislation preventing the outbreaks of contagious diseases, a dairy farmer applies more bio-security measures. As for animal identification, the farmer would have tagged his cattle anyway as he needs to identify his animals. However, the second tag was not of high importance and a lost tag would not be replaced in such a strict time frame, as this caused extra work. In general, farmers would do some cattle bookkeeping, but not as detailed as that required by the legislation. The paper work regarding the sale of home-grown fodder and recording medical treatments causes additional administrative work.

In Ireland, it is estimated that the cost of dairy concentrates has increased by 2% to 5% because of the regulations on feed hygiene and feed additives, respectively. Disease prevention mainly causes extra on-farm disinfection and the disposal of calves to the official knackery. Without these regulations, calves would be buried on farm. Additionally, farmers had to build quarantine facilities, which they would not have built otherwise. Farmers also spend more money and time on the identification and registration of their animals due to EU legislation. The set of directives concerning traceability of food requires additional administration work and bookkeeping.

In the Netherlands, feed mills had to optimise their production process in order to follow the standards regarding hygiene, undesirable substances, medicines, food safety, additives, labelling, storage, transport, and more. It was estimated that these adaptions increased feed costs. A disease control fund was set up for foot-and-mouth disease and each farmer is obliged to contribute to it. Since the BSE crisis, concentrates cannot contain animal protein, this type of concentrate is more expensive. Additional time is necessary for recording diseases and medical treatments.

In Poland, only the regulation regarding the identification and registration of animals was in force in 2010. Therefore cost of compliance was low compared to other EU Member States (0.2-0.4%), but is expected to rise as soon as more regulations are implemented in Poland.

In third countries such as Argentina and New Zealand, similar legislation is in place and increase the cost of production by about 0.6-0.8%. In Argentina, immunization against foot-and-mouth disease (FMD), brucellosis and tuberculosis played a major role in terms of cost of compliance.

In New Zealand, equivalent feed mill regulations either did not cause additional costs or were already part of the normal practices of feed mills. Changes in the production costs due to tuberculosis testing and vaccination for leptospirosis were minimal. Identification and registration

of animals require that all animals be tagged by ear tags and registered within one week of tagging. This regulation implicates administrative work. Diseases and medication have to be recorded in New Zealand for each animal.

Beef - The cost of compliance with food safety and animal health legislation of typical farms raising beef cattle account for 0.1 up to 1.0% of total production costs. Small differences emerge between France, Italy and the United Kingdom. The lowest compliance cost (0.1 %) was calculated on the larger UK typical farm.

In the UK, the benefit of traceability measures interests the total revenues (without these measures producers could not sell animals) and the absence of legislation on traceability would not change the producers' practices. The particularly high attention in the field of food safety can be attributed to the country-specific experience with the two diseases BSE and FMD and their disastrous economic consequences for the livestock industry's trade and reputation.

All European beef cattle farmers are required to replace all lost tags, causing extra work in terms of identification of the animals that lost the ear tags. In addition, beef cattle farmers have to keep exact records of all medical treatments and purchases of feed, roughage and raw materials. Compliance costs are therefore related to ear tag replacement, register updating and treatment recording.

Due to the food safety obligations imposed on the feed industry in France, Italy and the UK, an increase in the price of feed and concentrates was noticed. These increases resulted from a number of requirements, namely the regular inspection of feedstuffs, the requirements for storing hazardous substances in separate containers, the need for an authorisation to use certain additives in feed, the labelling costs of sound and genuine feed, and the costs of training staff in using the latest technologies.

In the beef sector, cost of compliance with food safety and animal health legislation is higher on typical farms in third countries investigated. In Brazil, for example, the impact accounted for up to 4.5% of the total costs. The high cost of compliance for the Brazilian farms is due to the fact that beef cattle farms cannot use beta-agonists when exporting beef to the EU

In Argentina, the cost of compliance is more similar to the EU situation and accounts for about 0.2-0.3% of the total cost of production.

Sheep - In the UK, as for the beef sector, particularly high attention is paid to the field of food safety and animal health. This can be attributed to the country-specific experience with the two diseases BSE and FMD, and their disastrous consequences for producers, consumers, livestock industries, trade and reputation. The high cost of compliance in the United Kingdom (between 2.2

and 2.4% of total costs) depends on the application of very restrictive rules for sheep identification, and on the setting of a 6-day standstill period for disease control. Additional costs include electronic ear tags and the disposal costs of dead animals outside the farm (non-factor costs).
In France, New Zealand and Australia compliance costs with food safety and animal health legislation are much lower and range between 0.2% and 1.2%.

Pigs - The highest compliance costs with food safety and animal health legislation are registered on the typical farms in Poland, accounting for 4.3% of the total costs. In other EU Member States, cost of compliance are much lower, accounting for 1.5% in Denmark, 1.9% in Germany, while in the Netherlands the impact is limited to 0.2% of the total costs
In Poland, most of the compliance costs are actually borne by the feed mills, who transmit these compliance costs to the Polish pig farmers in the form of higher feed prices. These higher feed prices are also linked to the gradual implementation of EU standards in the country. Costs are registered on the farm related to measures to improve bio-security. Bio-security measures include bio-security fences and gates, special clothes and shoe covers for visitors, truck baths, quarantine facilities and the correct disposal of dead animals. As in Poland pig vaccination is being carried out following national legislation, pig farmers do not have to bear extra compliance costs with EU regulations concerning the prevention of contagious diseases.
In Denmark, the food safety legislation concerning feed mills is passed on to the farmer through feed prices. The increase was linked to the ban on meat and bone meal in feed.
In Germany, the directives and regulations targeting feed mills caused an increase in feed prices, though variations are registered depending on feed type. Increases in production costs are mainly registered for holdings with more than 100 sows or more than 700 places for fatteners.
The costs related to compliance with the feed mill legislation are not relevant for the Dutch pig farmer. The impact of the disease control legislation on pork meat production shows a cost decrease due to investments in disease prevention.
In the third countries investigated, the impact is comparable to EU levels. In Brazil the compliance costs with food safety and animal health legislation is about 3% while it is negligible on the USA typical farms.
Brazilian legislation has an impact on feed mill costs, which are translated into higher feed prices for farmers. The Brazilian legislation concerning disease prevention on pig farms only sets measures for genetics producers (GRSC), which have to be certified by an official body. The cost of disease prevention in a typical GRSC farm is significant, yet it is assumed that the legislation requirements would still be adopted even if the legislation were not in place, both as a sanitary

measure and as an adaption to best available techniques. The same can be said for disease prevention costs.

In the USA, the measures that feed mills have to take are consistent with good management practices and food safety, so no compliance cost was identified. Disease control legislation does not impose any costs on the pork producers. Therefore, they are not relevant for the purpose of this analysis. The requirements for exporting pork to the EU can be met as long as pork producers refrain from using Ractopamine and provide a paper trail as proof. Hence, the costs of compliance associated with export to the EU are connected to eliminating Ractopamine from the diet. These costs have been estimated at 3.3% for US pig producers.

Broilers - Food safety and animal health legislation affects the broiler farms of all countries investigated. In EU Member States, cost of compliance ranges from 0.7-0.8% in Germany to 4.4% of the total costs in Italy.

In France, the cost of compliance with feed mill legislation leads to a price increase of compound feed. Most of the practices and investments on farms that are related to food safety legislation have an impact on production cost. Estimated compliance costs are quite similar for the two typical broiler farms in France.

In Germany, the extra costs due to feed mills have already been absorbed by the feed companies, as these directives were already implemented by German legislation. Costs generated by the disease control legislation are due to vaccination against Newcastle disease and salmonella prevention. For health monitoring and hygiene, costs are associated with veterinarian visits, sampling and documentation.

Also in Italy, the cost of compliance with food safety legislation for feed mill leads to a price increase of feed. Vaccination against Newcastle disease (ND) is mandatory. The regulation on prevention of zoonoses and salmonella requires that a swab sample be sent to a laboratory before slaughter for a salmonella analysis. For health monitoring and hygiene, as well as vaccine delivery, veterinarian visits are necessary. The additional work for sampling and documentation generates compliance costs.

In the third countries investigated, costs of compliance with food safety and animal health legislation for broiler farms are about 2.6-3% in Brazil and up to 2.7% in Thailand.

In Brazil, feed prices in the year 2010 would have been lower if producers would not have had to comply with the legislation. The disease control costs for a typical breeding farm are significant, but it is assumed that the practices described in these requirements would be followed by typical

breeders even without a specific legislation, as a sanitary measure and following best available techniques.
In Thailand, food safety costs are linked to the legislation related to anabolic substances. Under the hypothesis of the 'without legislation' scenario, the consequences for the farmers would be the absence of avian disease (HPAI) and New Castle (ND) surveillance and controls and the absence of biosecurity management plans. Moreover, the HACCP system and traceability measures foreseen by the private standards of the Assured Chicken Production would not have been adopted in broiler production.

Wheat - Compliance cost of the typical farms producing wheat is in general very limited and range from 0 to 0.6% of the total costs. Even though the annual costs of compliance are low, the expenditures for food safety and environmental regulations can be significant in the year of the investment. Costs in the field of food safety regulations are mainly driven by administrative labour time. If the overall cost effect is rather small, farmers perceive a high risk from food safety regulations. They fear that possible problems in the food chain could be traced back to their farm and that the retail industry would hold them responsible for damages.
Within the EU Member States considered, the small German typical farm shows the highest compliance cost for food safety regulations (0.1%). These costs are mainly caused by labour time for documentation. Similar situations apply in Denmark and the United Kingdom. In Hungary, due to low labour costs, the overall impact is lower than 0.1%.
In Canada food safety legislation has no cost impact. Farmers need to meet the export standards which became part of the common standards procedures.
The typical farms in Ukraine pay a fee for hazard containment analysis, which increases production costs by 0.4% to 0.6 %.

Apples - Generally, in all case studies in the different countries, issues regarding traceability, food hygiene and safety, modern business practices are common and would be carried out with or without legislation. In EU Member States, cost of compliance was identified on only one out of three German farms accounting for about 0.03% of the total costs. In Italy, the cost of compliance was calculated for the two typical farms with 0.6% and 0.7% of the total costs. In Italy the compliance with food safety regulations causes administration costs, emerging from the record keeping of the production and commercialization of apples, required for ensuring traceability and HACCP procedures. Costs for food samples and equipment cleaning are also relevant. Some items

do cause costs at farm level, such as specific requirements for record keeping which require more labour time. Since farms are small, even a few hours of extra labour have a visible cost impact.
In the third countries investigated, the food safety legislation's impact follows the same pattern. In the rather small Chilean farm, the impact is slightly higher than on the EU farms (1.2%). On the large farms with 80 to 120 ha, the costs of record keeping and eventual investments are hardly visible and amount to just 0.15% of total costs. In South Africa, the only requirement creating a cost is the record keeping and storage of the records for at least 5 years to ensure traceability.
Private standards like Global Gap and Tesco Nurture impose equal and sometimes stricter requirements in the field of environment and food safety than EU legislation. Since the compliance with such private standards is the basic condition for access to the EU market, the respective cost of compliance has been included for the third countries. Chile was the only country where actual costs beyond compliance with national legislation were identified by the expert panel. The farmers and experts who participated in panel discussions and individual interviews assessed many of the environmental and food safety requirements as useful practices, which they would not give up even if not required by law or a certification scheme. They pointed out that they are very conscientious and have a genuine interest in protecting the environment and maintaining their natural resources.

Wine grapes - In general, the analysis takes into account the production of wine grapes up to grape harvesting, and therefore quality measures and similar operations taking place at a later processing stage are not considered. Furthermore, traceability, food hygiene and safety are considered common modern business practices that would be implemented in any case. For these reasons, most of the typical farms analysed did not report compliance costs. Only the two South African typical farms are experiencing a cost of compliance due to food safety legislation. Specifically, these farms register a cost of compliance of 0.2-0.3% of the total costs due to regulations which require strict record keeping systems. Moreover, staff must attend additional training. Private standards in the wine sector allow compliance with the legislation in force. There are a number of programs requiring sustainable business practices including 'Terra vitis' (France), integrated production (Italy), Vitis program and EntWine (Australia), as well as Integrated Production of Wine (IPW) and Wine Industry Ethical Trade Association (WIETA) in South Africa.

5.4. Cost of compliance and competitiveness

Costs of compliance in this study have been expressed in % of the total costs estimated to produce a specific product unit. **A wide range of calculated costs of compliance has been observed and its**

impact on competitiveness by sector differs according to the products and countries. The question posed here is: how does the cost of compliance affect the internal competitiveness among EU Member States and, most importantly, towards third countries? To answer this question it is helpful to summarize the total costs of production by sector and the relative impact of costs of compliance in the EU and in the third countries investigated.

Dairy - There is a wide range of production costs in different EU Member States (IE, PL, DE, NL, FI) and a clear cost difference between the EU and third countries (NZ and AR). Among EU Member States, Ireland is producing milk at 26 €/100 kg while in Finland 100 kg milk in the 25 cows typical farm is produced at 75 €/100 kg. In Argentina and New Zealand, costs are lower (19 and 23 €/100 kg). The compliance costs for dairy farms in the EU range from 1 to 3%, whereas in the third countries, the cost of compliance ranges between 0.5 and 1%.
It can be stated that with these limited differences in compliance costs, EU Member States do not loose significant market shares.

Beef - In this sector the cost difference between EU Member States (FR, IT, UK) and third countries (AR and BR) is significant. In the UK, a large typical farm can produce beef meat at 402 €/100 kg meat, while a smaller farm in the same country produces at a cost of 610 €/100 kg meat. France and Italy show an intermediate level of costs at 427 €/100 kg and 492 €/100 kg respectively. In Brazil, 100 kg of meat can be produced at 178 €. The difference between the highest production cost in Brazil and the lowest production cost in the UK is about 224 €/100 kg meat (a 40% difference). Currently, import duties are partially defending EU beef production.
Compliance costs for beef producers in the EU range from 0.5% to 3%. In order to export to the EU, Brazil cannot use beta antagonists which increase the production costs by almost 5%. Argentina does not have this constraint as farmers do not use such substances.
The compliance with EU legislation does not worsen EU farmers' competitiveness on the world market. Thus, the difference in competitiveness does not result from the cost of compliance, but is due to the differences in overall production costs within and outside the EU.

Sheep - EU Member States (FR, UK) are producing 100 kg of sheep meat at production costs of about 300-350 €/100 kg meat, while the production costs for the same amount of product is less than 100 € in New Zealand and between 140 to 190 €/100 kg in Australia. So there is a significant cost difference between EU Member States and third countries. Production costs of sheep meat in

the selected EU Member States are at least two times higher than in New Zealand and Australia. Compliance costs for sheep farmers in the EU range between 0.5% and 3.5%, whereas compliance costs with equivalent legislation in Australia and New Zealand range from 0.5% to 1.7%.

Looking at the significant cost differences and at the limited impact of cost of compliance, it can be stated that the competitiveness of EU sheep production is not caused by compliance with legislation.

Pigs - Compliance costs in EU Member States range from 2.9 % in the Netherlands to up to about 9 % in Germany, whereas in Brazil these costs account for 3.3% of total costs and are negligible in the USA. Three EU Member States considered in this study (DK, DE, NL) are producing at similar levels of production costs (140-160 €/100 kg of meat). Polish farms are producing at an intermediate cost level (130 €/100 kg meat) due to low labour costs. Their cost of production is expected to reach the same level as other EU Member States in the near future. In third countries (BR and USA), pork meat is produced at 100-120 €/100 kg showing a cost difference of about 50 €/100 kg in respect to EU Member States.

For the pig sector, it can be concluded that compliance with EU legislation can temporarily have a negative impact on competitiveness compared to third countries.

Broilers - EU Member States (FR, DE, IT) are producing at a level of cost of production between 84 €/100 kg of meat in France and 98 €/100 kg meat in Italy. Thailand produces at a similar level as the selected EU Member States while Brazilian farms can produce broiler meat at only 60 €/100 kg of meat.

Compliance costs for EU broiler farms range from 1.4% in Germany to 5.5% in Italy. In the third countries investigated, they are around 3% and are due only to food safety legislation.

Therefore, some EU Member States suffer a reduction of competitiveness in broiler production, while others are in a more favourable position.

The competitiveness of Brazilian broilers on the EU and on third markets will continue to be particularly strong, because these producers comply with production standards on animal welfare and the environment which are similar to those in force in the EU, but produce at much lower production costs.

In conclusion, the analysis in terms of competitiveness of the animal production sectors investigated in this study shows that a significant cost gap exists between EU Member States and third countries. This difference would not disappear if the environmental, animal welfare and food safety legislation was not in place. Depending on different sectors and countries, in

the hypothetical absence of the legislation under consideration, only a limited improvement in terms of cost competitiveness could be expected. Competitiveness in terms of cost of production is more dependent on other drivers such as productivity, labour costs, feed prices and other input prices.

Wheat - In most of the countries analysed in this study, production costs range between 150 and 200 €/ton. In countries like Germany, Hungary, the United Kingdom, Canada and Ukraine, the level of cost of production is quite similar; there is not a significant cost difference between the EU and third countries in this sector. The only exception are the Danish typical farms, which produce at a much higher costs level (250 €/t).

Compliance costs of EU wheat producers are between 2 and 3.4% compared to 0 to 1% in Canada and Ukraine. Compliance with environmental and food safety standards does however increase the reliability of EU wheat on world markets.

The difference in compliance costs between the EU and third countries is marginal, except for the wheat producers in Denmark which are facing the highest compliance costs (3.4%) and already register high absolute production costs.

Apples - In Germany and Italy, total cost of production varies from about 380 € to 520 €/ton apples, The cost of producing apples are 2-4 times higher than in Chile and South Africa.

Cost of compliance with legislation is similar between the EU and third countries and ranges between 1 to 3%.

Both in the EU and in the third countries, similar types of legislation shall be respected. Compliance with legislation does not weaken the competitiveness of EU apple production.

Wine grapes - There is significant cost variation between the different typical farms investigated in this study. The number of variables in grape production is very high and the combination of factors can determine a cost competitiveness on different typical farms, even within the same country. Furthermore, grapes are not the final product of this supply chain. Wine processing and marketing can have a significant impact on the final product's competitiveness.

Cost of compliance is higher on typical farms in the EU in comparison to third countries and, as such, may negatively affect the competitiveness of this production. A final judgment on the competitiveness of this production could be given only when the compliance with legislation in wine processing would also be taken into account.

The analysis of the crop production sectors investigated in this study shows that in the apple sector a significant cost difference exists between EU Member States and third countries which is not determined by the cost of compliance with legislation, but primarily by differences in labour costs. In the wheat sector, the costs of production are at similar levels between most EU Member States and third countries and the costs of compliance do not affect production costs significantly. In wine grape production, compliance costs with EU legislation are higher than in third countries. However, a final judgment about competitiveness of the EU wine production on world markets is difficult to draw because of (1) the huge differences in varieties and wine qualities and (2) the compliance costs with legislation in wine production was not part of this study.

6. References

Baltussen, W.H.M., Hoste, R., Van der Veen, H.B., Bokma, S., Bens, P. and Zeewuster, H. (2010) *Economische gevolgen van toekomstige regelgeving op varkenshouderijbedrijven*. LEI. Den Haag

Beck, M., Asenova, D. and Dickson, G. (2005) *Public administration, science and risk assessment: a case study of the U.K. Bovine Spongiform Encephalopathy crisis*. Public Administration Review, 65 (4): 396-408

Benedictus, A., Hogeveen, H. and Berends, B.R. (2009) *The price of the precautionary principle: cost-effectiveness of BSE intervention strategies in the Netherlands*. Preventive Veterinary Medicine, 89: 212-22

Bennett, R. (1997) *Farm Animal Welfare and Food Policy*. Food Policy, 22(4): 281-288

Bennett, R.M. (1998) *Measuring Public support for animal welfare legislation: a case study of cage egg production*. Animal welfare, 7(1): 1-10

Bennett, R.M. and Blaney, R.J.P (2003) *Estimating the benefits of farm animal welfare legislation using contingent valuation method*. Agricultural Economics, 29: 85-98

Bezlepkina, I.V., Jongeneel, R., Brouwer, F., Dillen, K., Meister, A., Winsten, J., de Roest, K. and Demont, M. (2008) *Costs of compliance with EU regulations and competitiveness of the EU dairy sector*. 12th Congress of the European Association of Agricultural Economists, Ghent, Belgium

Boehlje, M.D. and Eidman, V.R. (1984) *Farm Management*. New York, John Wiley and Sons

Broom, D.M. (1991) *ANIMAL-WELFARE - CONCEPTS AND MEASUREMENT*. Journal of Animal Science, 69(10): 4167-4175

Brouwer, F., Baldock, D., Carpentier, C., Dwyer, J., Ervin, D., Fox, G., Meister, A. and Stringer, R. (2000) *Comparison of environmental and health-related standards influencing the relative competitiveness of EU agriculture vis-à-vis main competitors in the world market*. Agricultural Economics Research Institute. The Hague

Brouwer, F., Walker, A.J., Hoste, R. and van Wagenberg, C. (2011) *Literature study on the cost of compliance with EU legislation in the fields of environment, food safety and animal welfare*. Undertaken by Agricultural Economics Research Institute (LEI) - Wageningen UR. Executed on behalf of Directorate-General for Agriculture and Rural Development, European Commission

Buzby, J.C. and Chandran, R. (2003). *The Belgian dioxin crisis and its effects on agricultural production and exports*. In J.C. Buzby (eds.), International Trade and Food Safety: Economic Theory and Case Studies, Agricultural Economic Report n° 828: 125-139.

Camargo, J.A. and Alonso, A. (2006) *Ecological and toxicological effects of inorganic nitrogen pollution in aquatic ecosystems: a global assessment*. Environmental International**,** 32(6): 831-849

Caporale, V., Alessandrini, B., Dalla Villa, P. and Del Papa, S. (2005) *Global perspectives on animal welfare: Europe*. Revue Scientifique Et Technique-Office International Des Epizooties, 24(2): 567-577

Carlsson, F., Frykblom, P. and Lagerkvist, C. J. (2007) *Farm animal welfare: testing for market failure*. Journal of Agricultural and Applied Economics*,* 39: 61–73.

Carpenter, S.R., Caraco, N.F., Correll, D.L., Howarth, R.W., Sharpley A.N. and Smith, V.H. (1998). *Nonpoint pollution of surface waters with phosphorus and nitrogen*. Ecological Applications*,* 8: 559–568.

Cassells, S.M. and Meister, A.D. (2001) *Cost and trade impacts of environmental regulations: effluent control and the New Zealand dairy sector*. Australian Journal of Agricultural and Resource Economics, 45(2): 257-274

Caswell, J. (2007). *A multi-factorial risk prioritization framework for food-borne pathogens*. Working Paper 2007-8. Department of Resource Economics, University of Massachusetts Amherst.

Chotteau, P., Beaumond, N., Deblitz, C., Hoste, R., Magdelaine, P., Mottet, A., de Roest, K., Roguet, C., Sarzeaud, P., Topliff, M. and Van Horne, P.L.M. (2009) *The impact of increased operating costs on meat livestock in the EU*. Institut de l'Elevage. Paris, France

Coase, R.H. (1937) *The Nature of the Firm*. Economica, 4: 386-405

Coelli, T.J., Rao, D.S.P., O'Donnell, C.J. and Battese, G.E. (2005) *An introduction to efficiency and productivity analysis*. New York, Springer

Coggan, A., Whitten, S.M. and Bennett, J. (2010) *Influences of transaction costs in environmental policy*. Ecological Economics, 69(9): 1777-1784

Commons, J.R. (1934) *Institutional Economics: Its Place in Political Economy*. New York, Macmillan

Czap, N.V. and Czap, H.J. (2010) *An experimental investigation of revealed environmental concern*. Ecological Economics, 69(10): 2033-2041

da Costa, M.C., Deliza, R., Rosenthal, A., Hedderley, D. and Frewer, L. (2000) *Non conventional technologies and impact on consumer behavior*. Trends in Food Science & Technology, 11(4-5): 188-193

COWI. (2011). *The costs of not implementing the environmental acquis*, Final report ENV.G.1/FRA/2006/0073

Daatselaar, C.H.G., Doornewaard, G.J., Gardebroek, C., De Hoop, D.W. and Reijs, J.W. (2010) *Bedrijfsvoering, economie en milieukwaliteit; Hun onderlinge relaties bij melkveebedrijven*. LEI. Den Haag

Dalsted, N.L. and Gutierrez, P.H. (2010) *Partial Budgeting. No 3.760, 9/1992*. Colorado State University Cooperative Extension Service. Fort Collins

de Barcellos, M.D., Kügler, J.O., Grunert, K.G., Van Wezemael, L., Perez-Cueto, F.J.A., Ueland, Ø. and Verbeke, W. (2010) *European consumers' acceptance of beef processing technologies: a focus group study*. Innovative Food Science & Emerging Technologies, 11(4): 721-732

de Roest, K., Montanari, C., Fowler, T. and Baltussen, W. (2009) *Resource efficiency and economic implications of alternatives to surgical castration without anaesthesia*. Animal, 3(11): 1522-1531

de Roest, K., Winsten, J. and Dillen, K. (2011a) *Assessing the impact of nutrient management policies and growth hormone bans on international trade in beef: An EU/US perspective*. In: Brouwer, F., Fox, G. and Jongeneel, R. (eds.), *The economics of regulation in agriculture: Compliance with public and private standards*. Wallingford, CABi

de Roest, K., Winsten, J., Rajsic, P. and Dillen, K. (2011b) *The trade effects of the environmental compliance for the hog sectors in the European Union*. In: Brouwer, F., Fox, G. and Jongeneel, R. (eds.), *The economics of regulation in agriculture: Compliance with public and private standards*. Wallingford, CABi

Deblitz, C. [editor] (2011) *Beef and sheep report 2011: understanding agriculture worldwide*. Braunschweig; Fankfurt am Main: vTI; DLG, 86 pages

Deblitz, C., Dhuyvetter, K.C. (2013) *Cost of production and competitiveness of beef production in Canada, the US and the EU*. in print

Debliz, C., Zimmer, Y. (2005) *Agri-benchmark beef: a standard operating procedure to define typical farms*. Braunschweig: FAL, 20 pages

Dijkhuizen, A.A. and Morris, R.S. (1997) *Animal health economics: Principles and applications*. Sydney, University of Sydney

Entec (2008) *Assistance on the impact assessment of the extended Nitrate Vulnerable Zones in England and Revised Action Programme measures*. London

Esturo, A., Gonzalez, N., Greno, P., Martinez-Granado, M. and de Buruaga, M.S. (2010) *The cost of food safety due to animal by-product regulation in Spain: who pays for it?* In: Aravossis, K. and Brebbia, C.A. (eds.), *Environmental Economics and Investment Assessment Iii*. Southampton, Wit Press, pp. 71-82

European Commission (2010) *The Nitrates Directive Fact sheet* http://ec.europa.eu/environment/pubs/pdf/factsheets/nitrates.pdf Last accessed at 11.10.2013

Fearne, A. and Walters, R. (2004) *The costs and benefits of farm assurance to livestock producers in England*. Centre for Food Chain Research, Department of Agricultural Sciences, Imperial College London. Wye, Ashford, Kent, U.K., pp. 159

Ferguson, C.E. (2008) *The Neoclassical Theory of Production and Distribution*. Cambridge, Cambridge University Press, pp. 404

Frykblom, P. (1998) *Halved emissions of nutrients, what are the benefits? A contingent valuation method survey applied to Laholm Bay*, in Questions in the contingent valuation method – five essays. Swedish University of Agricultural Sciences, Uppsala.

Garnier, J.P., Klont, R. and Plastow, G. (2003) *The potential impact of current animal research on the meat industry and consumer attitudes towards meat*. Meat Science, 63(1): 79-88

Givens, J.E. and Jorgenson, A.K. (2011) *The Effects of Affluence, Economic Development, and Environmental Degradation on Environmental Concern: A Multilevel Analysis*. Organization & Environment, 24(1): 74-91

Glebe (2007) *The environmental impact of European farming: How legitimate are agri-environmental payments?* Applied economic perspectives and policy, 29(1): 87-102

Gourmelen, C., Ilare, E., Dagorn, J., Daridan, D., Ferneij, J.P.v., Marouby, H., Rieu, M. and Teffene, O. (2004) *Le coût des contraintes réglementaires pour la production porcine française*. TechniPorc, 27(8)

Grethe, H. (2007) *High animal welfare standards in the EU and international trade - How to prevent potential 'low animal welfare havens'?* Food Policy, 32(3): 315-333

Grunert, K.G. (2005) *Food quality and safety: consumer perception and demand*. European Review of Agricultural Economics, 32(3): 369-391

Hall, C., McVittie, A. and Moran, D. (2004) *What does the public want from agriculture and the countryside? A review of evidence and methods*. Journal of Rural Studies, 20: 211-225

Hanley, N. (1991) *The economics of nitrate pollution control in the UK* in Hanley, N. (ed) Farming and the Countryside: An economic analysis of external costs and benefits. Oxford CAB International.

Hellerstein, D., Nickerson, C., Cooper, J., Feather, A.P., Gadsby, D., Mullarkey, D., Tegene, A. and Barnard, C. (2002) *Farmland protection and the role of public preferences for rural amenities report 815*. USDA Economic Research Service

Hemme, T. [editor] (2011) *IFCN dairy report 2011*. International Farm Comparison Network, IFCN Dairy Research Center, Kiel, Germany

Hennesy D.A. (2007) *Biosecurity and spread of an infectious disease* America Journal of Agricultural Economics 89: 1226-1231

Henson, S. and Caswell, J. (1999) *Food safety regulation: an overview of contemporary issues*. Food Policy, 24(6): 589-603

Henson, S. and Reardon, T. (2005) *Private agri-food standards: Implications for food policy and the agri-food system*. Food Policy, 30(3): 241-253

International Energy Agency (2013) *Agricultural methane emissions (% of total).* http://data.worldbank.org/indicator/EN.ATM.METH.AG.ZS Last accessed 11.10.2013

IEEP, GHK (2010) *Costs and socio-economic benefits associated with the Natura 2000 Network*

Ipema, A.H., Smits, A.C., Hogewerf, P.H., Houwers, W., van der Walle, K., Velthuis, A.G.J., Hogeveen, H., Hoste, R., Van Wagenberg, C.P.A. and Puister-Jansen, L.F. (2003) *Haalbaarheidsonderzoek elektronische identificatie. Rapport 2002-07*. IMAG. Wageningen, pp. 234

Jacob, M. and Hellström, T. (2000) *Policy understanding of science, public trust and the BSE-CJD crisis*. Journal of Hazardous materials, 78(1-3): 303-317

Jacobsen, B.H. (2004) *Final economic evaluation of the Action Plan for the Aquatic Environment II (In Danish with English summary)*. Fødevareøkonomisk Institut. Copenhagen

Johansson, P.-O. (1993) *Cost-benefit analysis of environmental change*. Cambridge University Press, UK.

Jongeneel, R., Brouwer, F., Farmer, M., Müssner, R., Roest, K.d., Poux, X., Fox, G., Meister, A., Karaczun, Z., Winsten, J. and Ortéga, C. (2007) *Compliance with mandatory standards in agriculture. A comparative approach of the EU vis-à-vis the United States, Canada and New Zealand.* LEI. Den Haag

Kangas, S., Lyytikainen, T., Peltola, J., Ranta, J. and Maijala, R. (2007) *Costs of two alternative Salmonella control policies in Finnish broiler production*. Acta Veterinaria Scandinavia, 49: 35-42

King, R.P., Backus, G.B.C. and van der Gaag, M.A. (2007) *Incentive systems for food quality control with repeated deliveries: Salmonella control in pork production*. European Review of Agricultural Economics, 34(1): 81-104

Kiss, P. and Weingarten, P. (2003) *Cost of compliance with the Acquis Communitaire in the Hungarian dairy sector* IAMO discussion paper no. 55. Halle, Germany

Komen, M.H.C. and Peerlings, J.H.M. (1998) *Restricting intensive livestock production: Economic effects of mineral policy in the Netherlands*. European Review of Agricultural Economics, 25(1): 110-128

Lagerkvist, C.A. and Hess, S. (2011) *A meta-analysis of consumer willingness to pay for farm animal welfare*. European Review of Agricultural Economics, 38 (1): 55–78

Lagerkvist, C.J., Hansson, H., Hess, S. and Hoffman, R. (2011) *Provision of Farm Animal Welfare: Integrating Productivity and Non-Use Values*. Applied Economic Perspectives and Policy, 33(4): 484-509

Liljenstolpe, C. (2008) *Evaluating animal welfare with choice experiments: an application to Swedish pig production*. Agribusiness, 24(1): 67-84

LKS (2009) *Estudio sobre las consequencias de la aplicación del modelo de producción europeo al sector español del huevo y sus productos*. LKS. Spain

Lloyd, T.A., McCorriston, S., Morgan, C.W. and Rayner, A.J. (2006) *Food scares, market power and price transmission: the UK BSE crisis*. European Review of Agricultural Economics, 33(2): 119-147.

Loader, R. and Hobbs, J.E. (1996) *The hidden costs and benefits of BSE*. British Food Journal, 98(11): 26 - 35

Loader, R. and Hobbs, J.E. (1999) *Strategic responses to food safety legislation*. Food Policy, 24(6): 685-706

Lusk, J.L. and Norwood, F.B. (2011) *Animal Welfare Economics*. Applied Economic Perspectives and Policy, 33(4): 463-483

Mahvi, H., Nouri, J., Babaei, A.A. and Nabizadeh, R. (2005) *Agricultural activities impact on groundwater nitrate pollution*. International Journal of Environmental Science and Technology, 2(1): 41-47

McDonald, S. and Roberts, D. (1998) *The economy-wide effects of the BSE crisis: a CGE analysis*. Journal of Agricultural Economics, 49(3): 458-471

Mettepenningen, E., Verspecht, A. and Van Huylenbroeck, G. (2009) *Measuring private transaction costs of European agri-environmental schemes*. Journal of Environmental Planning and Management, 52(5): 649-667

Ngapo, T.M., Dransfield, E., Martin, J.F., Magnusson, M., Bredahl, L., and Nute, G.R. (2003) *Consumers perceptions: pork and pig productions. Insights from France, England Sweden and Denmark*. Meat Science, 66: 125–134

Niehans, J. (1971) *Money and Barter in General Equilibrium with Transaction Costs*. American Economic Review, 61(5): 773-778

Nielsen, H.B., Sonne, A.-M., Grunert, K.G., Banati, D., Pollák-Tóth, A., Lakner, Z., Olsen, N.V., Zontar, T.P. and Peterman, M. (2009) *Consumer perception of the use of high-pressure processing and pulsed electric field technologies in food production*. Appetite, 52(1): 115-126

Niva, M. and Mäkelä, J. (2007) *Finns and functional foods: socio-demographics, health efforts, notions of technology and the acceptability of health-promoting foods*. International Journal of Consumer Studies, 31(1): 34-45

North, D.C. (1991) *Institutions*. The Journal of Economic Perspectives, 5(1): 97-112.

Parkin, M., Powell, M. and Matthews, K. (2008) *Economics*. Essex, Pearson Education Limited, pp. 830

Picazo-Tadeo, A.J. and Reig-Martinez, E. (2007) *Farmers' costs of environmental regulation: Reducing the consumption of nitrogen in citrus farming*. Economic Modelling, 24(2): 312-328

Rugman, A.M., Kirton, J. and Soloway, J. (1997) *NAFTA, environmental regulations, and Canadian competitiveness*. Journal of World Trade, 31(4): 129-144

Ryan, M. (2006) *Integrated Pollution Prevention and Control. Assessment of the Cost of Implementation of the Directive for Farm Businesses in England. Rural development service*

Saa, C., Milan, M.J., Caja, G. and Ghirardi, J.J. (2005) *Cost evaluation of the use of conventional and electronic identification and registration systems for the national sheep and goat populations in Spain*. Journal of Animal Science, 83(5): 1215-1225

Stenger, A. and Willinger, M. (1998) *Preservation value for groundwater quality in a large aquifer: a contingent-valuation study of the Alsatian aquifer*. Journal of Environmental Management, 53(2): 177-193

Tobey, J.A. (1991) *The effects of environmental-policy towards agriculture on trade: some considerations*. Food Policy, 16(2): 90-94

Traill, W.B., Koenig, A. (2010) *Economic assessment of food safety standards: costs and benefits of alternative approaches*. Food Control, 21(12): 1611-1619

Uthes, S., Sattler, C., Zander, P., Piorr, A., Matzdorf, B., Damgaard, M., Sahrbacher, A., Schuler, J., Kjeldsen, C., Heinrich, U. and Fischer, H. (2010) *Modeling a farm population to estimate on-farm compliance costs and environmental effects of a grassland extensification scheme at the regional scale*. Agricultural Systems, 103(5): 282-293

Valeeva, N.I., De Smet, A., Hoste, R. and Backus, G.B.C. (2010) *Cost-effectiveness of preventing boar taint without surgical castration in the pork chain*. 9th Wageningen International Conference on Chain and Network Management, Wageningen

van der Straeten, B., Buysse, J., Nolte, S., Lauwers, L., Claeys, D. and Van Huylenbroeck, G. (2010) *A multi-agent simulation model for spatial optimisation of manure allocation*. Journal of Environmental Planning and Management, 53(8): 1011-1030

van Grinsven, H.JM., Rabl, A. de Kok, T.M., (2010) *Estimation of incidence and social cost of colon cancer due to nitrate in drinking water in the EU: a tentative cost-benefit assessment*. Environmental Health, 9:58

van Horne, P.L.M. and Achterbosch, T.J. (2008) *Animal welfare in poultry production systems: impact of EU standards on world trade*. Worlds Poultry Science Journal, 64(1): 40-51

van Horne, P.L.M., Hoste, R., Haan, B.J.d., Ellen, H., Hoofs, A. and Bosma, B. (2006) *Gevolgen van aanpassingen in het ammoniakbeleid voor de intensieve veehouderij. Onderzoek naar de economische aspecten van en de gevolgen voor de ammoniakdoelstellingen bij intern salderen van ammoniakemissie, versoepeling van de WAV en het niet emissiearm maken van bestaande stallen.* LEI. Den Haag

van Huylenbroeck, G., Vandermeulen, V., Mettepenningen, E. and Verspecht, A. (2007) *Multifunctionality of agriculture: a review of definitions, evidence and instruments*. Living Reviews in Landscape Research 1(3)

van Wagenberg, C.P.A., Van Bavel, M.A.H.J. and Bondt, N. (2004) *Lastenverzwaringen door de EU-verordening diervoederhygiëne. Extra lasten boven de gangbare praktijken inzake diervoederhygiëne. Internal report*. LEI. Den Haag, pp. 96

van Wezemael, L., Verbeke, W., Kugler, J.O., de Barcellos, M.D. and Grunert, K.G. (2010) *European consumers and beef safety: Perceptions, expectations and uncertainty reduction strategies*. Food Control, 21(6): 835-844

Vanhonacker, F. and Verbeke, W. (2009) *Buying higher welfare poultry products? Profiling Flemish consumers who do and do not*. Poultry Science, 88(12): 2702-2711

Vanhonacker, F., Verbeke, W., Van Poucke, E. and Tuyttens, F.A.M. (2008) *Do citizens and farmers interpret the concept of farm animal welfare differently?* Livestock Science, 116(1-3): 126-136

Veissier, I., Butterworth, A., Bock, B. and Roe, E. (2008) *European approaches to ensure good animal welfare*. Applied Animal Behaviour Science*,* 113(4): 279-297

Vermeir, I. and Verbeke, W. (2006) *Sustainable food consumption: Exploring the consumer "attitude - behavioral intention" gap*. Journal of Agricultural & Environmental Ethics, 19(2): 169-194

Vermeire, B., Verspecht, A. and Gellynck, X. (2009) *Development of an economic valuation model for green infrastructure on the basis of a literature review*. Ghent/Bruges, Belgium.

Vukina, T. and Wossink, A. (2000) *Environmental policies and agricultural land values: Evidence from the Dutch nutrient quota system*. Land Economics, 76(3): 413-429

Webb, D. (2008) *The economic and social impact of the Institute for Animal Health's work on Foot and Mouth Disease*, DTZ, Edinburgh

Williamson, O.E. (1985) *The Economic Institutions of Capitalism*. New York, The Free Press

Williamson, O.E. (1991) *Comparative Economic Organization: The Analysis of Discrete Structural Alternatives*. Administrative Science Quarterly, 36(2): 269-296

Williamson, O.E. (1996) *The mechanisms of governance*. New York, Oxford University Press

Williamson, O.E. (2003) *Transaction Cost Economics and Agriculture: An Excursion*. In: Van Huylenbroeck, G., Verbeke, W. and Lauwers, L. (eds.), *Role of Institutions in Rural Policies and Agriculture*, Elsevier

Williamson, O.E. (2005) *Transaction Cost Economics*. In: Ménard, C. and Shirley, M.M. (eds.), *Handbook of New Institutional Economics*. The Netherlands, Springer, pp. 41-65

Williamson, O.E. and Masten, S.E. (1999) *The Economics of Transaction Costs*. Cheltenham, UK, Elgar Critical Writings Reader

Zasada, I. (2011) *Multifunctional peri-urban agriculture-A review of societal demands and the provision of goods and services by farming*. Land Use Policy, 28(4): 639-648

Annex 1: List of 40 EU Directives and Regulations, as well as the GAECs that were taken into consideration in the study:

LEGISLATION	DAIRY	BEEF MEAT	SHEEP MEAT	PIG MEAT	BROILER MEAT	WHEAT	APPLE	WINE GRAPES
ENVIRONMENT								
Directive on Plant protection products (1107/2009/EC)						X	X	X
Directive on Sustainable use of pesticides (2009/128/EC)						X	X	X
Nitrate Directive (91/676/EEC)	X	X	X	X	X	X	X	X
Habitat Directive (92/43/EEC)			X					
IPPC Directive (2008/1/EC)				X	X			
GAEC 1 – Minimum soil cover						X		
GAEC 1a – Land management						X		
GAEC 2 – Establishment of buffer strips							X	X
GAEC 2a – Establishment of buffer strips in UK and DK						X		
GAEC 3 – Crop rotation						X		
GAEC 4 – Avoiding encroachment of unwanted vegetation						X	X	X
GAEC 5 – Retention of landscape features						X	X	X
ANIMAL WELFARE								
Directive on Chickens kept for meat production (2007/43/EC)					X			
Directive on Protection of animals kept for farming purposes (98/58/EC)			X					
Directive on Protection of calves (2008/119/EC)	X	X						
Directive on Protection of pigs (2008/120/EC)				X				
FOOD SAFETY								
Directive on Control of classical swine fever (2003/85/EC)				X				
Directive on Control of foot-and-mouth disease (2001/89/EC)				X				
Directive on Control of swine vesicular disease (92/119/EEC)				X				
Directive on Medicated feedstuffs (90/167/EEC)	X	X	X	X	X			
Directive on Prevention of avian influenza (2005/94/EC)					X			
Directive on Prevention of bluetongue (2000/75/EC)	X	X						
Directive on Prevention of foot-and-mouth disease (2003/85/EC)	X	X	X					

LEGISLATION	DAIRY	BEEF MEAT	SHEEP MEAT	PIG MEAT	BROILER MEAT	WHEAT	APPLE	WINE GRAPES
Directive on Prevention of Newcastle disease (92/66/EEC)					X			
Directive on Prevention of zoonoses and zoonotic agents (2003/99/EC)	X	X	X	X	X			
Directive on Prohibition of hormonal substances (96/22/EC)	X	X		X				
Directive on Undesirable substances in animal feed (2002/32/EC)	X	X	X	X	X			
Regulation on Additives for use in animal nutrition (1831/2003)	X	X	X	X	X			
Regulation on Animal by-products not intended for human consumption (1774/2002)				X	X			
Regulation on Feed hygiene (183/2005)	X			X				
Regulation on General principles and requirements of food law (178/2002)	X	X				X	X	X
Regulation on Hygiene of foodstuffs (852/2004)						X	X	X
Regulation on Hygiene rules for food of animal origin (853/2004)	X							
Regulation on Identification and registration of bovine animals (1760/2000)	X	X						
Regulation on Identification and registration of ovine and caprine animals (21/2004)			X					
Regulation on Marketing and use of feed (767/2009)	X							
Regulation on Maximum residue levels of pesticides in or on food and feed of plant and animal origin (396/2005)						X		
Regulation on Placing on the market and use of feed (767/2009)		X	X	X	X			
Regulation on Prevention of Salmonella (2160/2003)					X			
Regulation on Prevention of TSE (999/2001)	X	X						
Regulation on Requirements for feed hygiene (183/2005)		X	X		X			
Regulation on Traceability requirements set by Regulation 178/2002 (931/2011)	X	X						