EUROPEAN COMMISSION
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ELECTRONIC IDENTIFICATION (EID)

OF SMALL RUMINANTS

IN ACCORDANCE WITH REGULATION (EC) 21/2004

COST ANALYSIS

FOR SMALL RUMINANT HOLDINGS

IN

MEMBER STATES

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Table of contents

OVERVIEW SUMMARY

This document gives a general cost analysis regarding the electronic identification of sheep and goats in accordance with Regulation (EC) 21/2004. The structure of the sheep and goat farming industry in the EU differs considerably between Member States. This document uses a cost model based on breeding farms of different sizes. The model allows a modification of certain parameters, such as reproduction or replacement rate of a flock, labour costs, number of movements or costs of devices to adapt to different and more specific farm types and farming conditions.

The analysis looks mainly at the costs which will occur to fulfill the minimum requirements of Regulation (EC) 21/2004 as regards the identification and registration of animals at farm level. Additional costs as well as the benefits, e.g. for the reading at slaughterhouses or in specialized farms are highlighted and quantified if possible. The document contains on the cost side two main parts and a part regarding benefits:

- Costs at flock level with average EU labour costs taking into account a possible derogation for slaughter lambs;
- Costs at flock and Member State level using average labour costs and the holding structure in the Member States;
- Benefits along the production chain.

Costs and benefits at flock level on an EU average: The costs for the individual identification of sheep or goats are calculated for ruminal boluses and electronic ear tags for all animals of the nucleus flock and their offspring. In parallel, the costs are shown when 60% of the offspring are identified as batches with a holding ID in accordance with the derogation of Article 4 (3) of Regulation (EC) 21/2004 (animals intended for slaughter before the age of 12 months - slaughter lambs).

The costs for the identification in the presented general model range between 2.25€ for an animal to be tagged with a standard ruminal bolus and a conventional ear tag and 1.80€ when tagged with an electronic and a conventional ear tag. The tagging with two conventional 15-digit ear tags would costs 1.03€ and for tagging slaughter lambs with one holding tag 0.29€.

EID reduces the costs for reading of the identifiers due to timesaving. As more an electronic reading device is used in electronically identified animals, as more its advantages become apparent. In a large flock (1000 heads) it would cost per head between 0.10 € (handheld reader) and 0.38 € (static reader) with one reading per year. When the same equipment is used to read the flock 10 times a year, costs would drop to 0.04 - 0.06 € per head, respectively. This has to be compared with about 0.17 € per head for one conventional reading of the individual identifiers. With EID the further handling of the read identifiers in a computerized system, such as an electronic herd registers or management system could bring additional time savings.

For larger flocks (500 to 1000 breeding animals) EID would bring immediate savings compared to conventional identification, reading and data handling. For holdings with 50 to 100 breeding animals the higher costs for the electronic devices would be compensated by labour cost savings when the flock has to be read frequently (e.g. in milking flocks). For holdings of that size savings could also be achieved when sharing reading equipment, e.g. in associations or cooperatives.

For holdings such as livestock markets and slaughterhouses the reading costs per animal could be reduced considerably with EID compared to the conventional reading of a 15-digit ear tag.

Depending on the throughput of the establishment the per-head EID reading costs would be between 0.02€ and 0.13€ compared to 0.50€ for the conventional reading at a market.

Costs and benefits at individual Member State level: In relation to the average labour costs in the different Member States and the assumption that the electronic identifiers can be bought throughout the Community at equal prices the costs for EID may vary between 1.92€ and 2.45€ per animal when using ruminal boluses and between 1.47€ and 1.99€ when using electronic ear tags.

In the Member States, the per-head costs for reading electronic identifiers would be very similar to the EU average when one reading is performed per year. With ten readings a year the cost saving effect becomes apparent in particular in the Member States with higher labour costs.

Conclusions: The analysis concludes that individual identification cannot be achieved without electronic identification and reading. The general model shows that with the requirement of Regulation (EC) 21/2004 for individual 15-digit identification of sheep and goats, larger numbers of animals can not be handled without an automated reading. This applies for larger flocks as well as for markets, collection centers and slaughterhouses where large numbers of animals have to be read within a short time.

The derogation from EID for animals intended for slaughter before the age of 12 months would save costs for the holdings of birth but could exclude livestock markets and slaughterhouses to take full advantage of an automated reading of the identification and would bring additional burden to them (different handling and flow of animals). Member States which opt for this derogation can take only partial advantages of EID, e.g. regarding official controls, traceability, farm management and consumer information, with more or less the same investments.

Although it is not always possible to quantify all advantages in monetary terms, the individual identification would bring added value for the herd management, official controls, the small ruminant sector in general, the downstream processing and for the consumer.

1. OBJECTIVES

The present document is aimed to provide in a general model a qualitative and as far as possible a quantitative cost analysis of EID for small ruminant farms as well as for the national flock of a Member State on the basis of the requirements of Council Regulation (EC) 21/2004 [(1)]. It also indicates some of the benefits which are associated with EID. Since the above Regulation requires an individual identification of small ruminants containing the Member State code and a 12-13 digit individual animal code, irrespectively if EID will be applied from 1 January 2008 this document will not compare electronic identification with other systems of conventional identification.

The model is limited to the phase when EID has to be applied and does not take into account costs for the preparatory phase since those costs may differ widely between Member States depending what approach is taken and how this phase is organized. There are most likely costs occurring during the preparatory phase, such as consultation and information activities, trainings or administrative arrangements.

2. OPTIONS FOR EID AND ASSUMPTIONS

OPTIONS FOR EID

One of the principle requirements of Regulation (EC) 21/2004 is the identification of each animal with two means of identification displaying the Member State's and a 12 to 13-digit individual animal code. By 1 January 2008, EID is foreseen to become obligatory for all small ruminants. Regulation (EC) 21/2004 opens several options and derogations for the implementation of EID which can be either

A) One ear tag + one bolus: conventional ear tag and a ruminal bolus containing the same characters, or

B) Two ear tags: conventional ear tag and electronic ear tag containing the same characters.

As regards animals intended for slaughter before the age of 12 months and neither intended for intra-Community trade nor for export, they have to be either identified as under option A or B, or by

C) One holding ear tag: the competent authorities may authorise the identification by one ear tag containing the country code and the identification code for the holding of birth.

D) Two ear tags: two conventional ear tags for Member States with a national flock of not more than 600,000 ovines and caprines or not more than 160,000 caprines which will not apply EID for the animals not involved in intra-Community trade.

This analysis compares the costs for the options A, B, C and D for a range of different holding sizes leading to calculated costs for breeding holdings in the Member States. If not specially mentioned, the costs to keep holding registers and movement documents as well as the different options for them are not included in the cost analysis.

ASSUMPTIONS FOR THE CALCULATIONS

For the calculations and cost analyses the following assumptions have been made which are based on data and information received from the consulted parties, the technical guidelines for Regulation 21/2004 – Part 1 and 2, version 1.0, issued 10/07/2006 [(2)] and JRC's own experience in the field of EID (for the detailed assumptions see Annex I).

- **Flock structure**: The number of offspring is calculated for flocks of 10, 50, 100, 500 and 1000 breeding animals (nucleus flock) on the basis of an average annual production rate of 90% (9 lambs/kids per 10 ewes or goats per year). Unless specifically mentioned by Member States, 22% of offspring were considered to be used for replacement, 60% to be sent for slaughter before 12 months of age and 18% leaving the holding but not intended for slaughter before the age of 12 months.;
- **Costs for identification equipment**: these include conventional, electronic ear tags and standard ruminal boluses as well as the applicators. The costs are based on average prices without VAT received from manufacturers/suppliers and to recent calls for tender in some Member States (conventional ear tag 0.30€, holding tag 0.10€, electronic ear tag 1.00€ and standard bolus 1.50€). The annual replacement rate for identifiers is set to 0.1% for boluses and 5% for ear tags.
- **Costs for the reading equipment**: these include handheld readers with up- and download function as well as static readers (fixed to a reading point). The costs are based on average prices without VAT received from manufacturers/suppliers and to recent calls for tender in some Member States (300€ for a handheld and 1.500€ for a static reader). As common for electronic equipment, the depreciation of readers is spread over 3 years. It is assumed that holdings with around 1000 breeding animals would have 2 handheld and 1 static reader, such with 500 breeding animals 1 handheld and 1 static reader, such with 50 to 100 breeding animals 1 handheld reader and holdings with not more than 10 breeding animals no reader.
- **Costs for the equipment to process read identifiers:** Although not strictly required by Regulation (EC) 21/2004, EID allows automating the further handling of the identifiers read. Irrespectively if handheld or static readers are used, the data could be sent or downloaded to a weight scale head, an electronic herd register or management system and vice versa. For this operation a computer and software which is able to communicate with the reader software are necessary. To automate processing of documents, such as movement documents or lists, a printer would be required. The costs for computer, software and printer are calculated with 900€ with a depreciation of 3 years.
- **Costs for manpower:** manpower for tagging and reading is based for each Member State on EUROSTAT figures for 2004. For the general calculation 20€/hour are used as an EU average.

  Tagging: From the experience gained it is assumed that it takes a trained person 1 minute per animal to apply the double identification (2 ear tags or 1 ear tag and 1 bolus). 2 animals could be marked per minute with 1 holding tag each.

  Reading: The same experience showed that with a static reader some 100 electronically tagged animals can be read within 2.5 minutes; with a handheld reader it takes around 5 seconds to read an animal. 30 seconds are calculated for reading a 15-digit conventional ear tag and to write it down on a list or note block. It is considered that reading animals with a holding tag and issuing the movement document would take between 10-15 minutes, irrespectively of the size of the batch of animals. For animals to be replaced and surplus offspring one reading is calculated when moved off holding.

  Processing of read identifiers: For each up or download from a handheld reader cost are calculated equivalent to 5 minutes work. When working with a static reader it is assumed that data are automatically transfered to the computer and therefore no additional labour costs have

to be taken into account. Half a minute is considered to enter a conventional 15-digit ear tag manually from block notes or lists into a herd register or management records.

3. COST ANALYSIS OF THE DIFFERENT OPTIONS FOR HOLDINGS ON AN EU AVERAGE

This chapter summarizes the qualitative and quantitative analysis of the most important economical impacts for the main actors of the implementation.

COSTS FOR THE IDENTIFCATION

Per-head costs: Using the model and parameters as specified in the assumptions, average per-head costs for the identification of different categories of animals on a holding (breeding ewes, replacement animals, animals to be sold but not intended for slaughter before 12 months of age and animals intended for slaughter before the age of 12 months) would occur as shown in the two tables below. The costs are calculated for the electronic identification using 1 standard ruminal bolus plus 1 conventional ear tag or 1 electronic and 1 conventional ear tag. In this model the means of identification of animals intended for slaughter before the age of 12 months would be 1 holding tag. In comparison, in Member States which derogate the flocks from electronic identification the means would be 2 conventional 15-digit ear tags.

	Costs per animal identified			
Type of identification	Ruminal bolus + CID*)	Electronic ear tag + CID	One holding ear tag	two CIDs
EID tagging				
Equipment: identifiers. applicators	€ 1.90	€ 1.44	€ 0,12	€ 0.67
manpower	€ 0.36	€ 0.36	€ 0,17	€ 0.36
Total	**€ 2.25**	**€ 1.80**	**€ 0.29**	**€ 1.03**

***) CID:** conventional 15-digit ear tag

Table 1: Per-head costs for the electronic identification compared to conventional identification

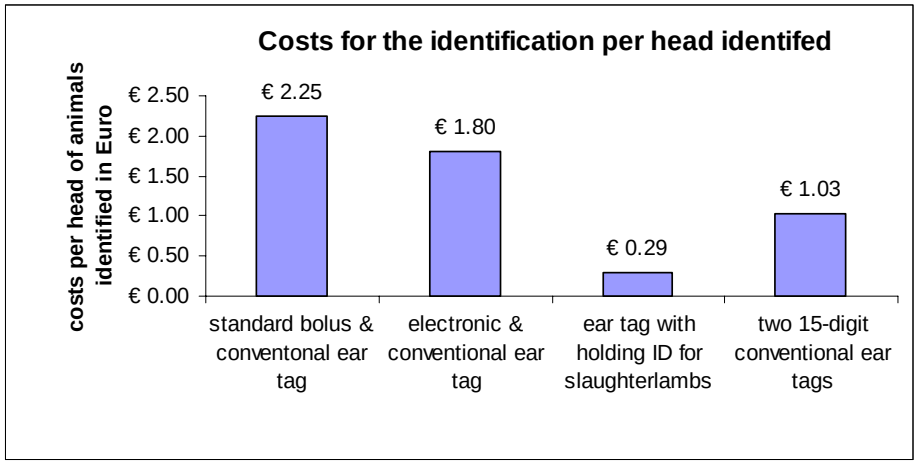

Table 2: Per-head costs for ruminal boluses, electronic ear tags, holding tags and conventional 15-digit tags

After the initial phase (1st year), costs occur in the following years mainly for the tagging of offspring and animals imported from third countries. When retagged with an identical identifier, the costs for the retagging in the nucleus flock differ between ruminal bolus (1.59€), electronic ear tag (2.52€) and conventional ear tag (1.52€) mainly due to the different retagging rates assumed. The authorities may also allow retagging with an identifier with a different individual code when traceability is not compromised.

Equipment and manpower: The investment for starting EID in a sheep or goat flock in accordance with Regulation 21/2004 depends mainly on the size of the nucleus flock and the type of electronic identifiers (see table below). In the 2nd and following years the equipment costs will be substantially lower as identifiers are mainly needed for the offspring and some retagging.

Costs identifiers. applicators. labour / **Flock of**	**EID with ruminal boluses**				**EID with electronic ear tags**			
	First year		Second year		First year		Second year	
	equip-ment	labour	equip-ment	labour	equip-ment	labour	equip-ment	labour
1000 ewes	€ 2,666	€ 579	€ 806	€ 245	€ 2.018	€ 579	€ 658	€ 244
	€ 3,245		**€ 1,051**		**€ 2,597**		**€ 902**	
500 ewes	€ 1,329	€ 289	€ 409	€ 123	€ 1.019	€ 289	€ 350	€ 122
	€ 1,618		**€ 532**		**€ 1,308**		**€ 472**	
100 ewes	€ 294	€ 58	€ 74	€ 25	€ 231	€ 58	€ 61	€ 24
	€ 352		**€ 99**		**€ 289**		**€ 85**	
50 ewes	€ 169	€ 29	€ 39	€ 12	€ 138	€ 29	€ 33	€ 12
	€ 198		**€ 51**		**€ 167**		**€ 45**	
10 ewes	€ 66	€ 6	€ 8	€ 2	€ 60	€ 6	€ 7	€ 2
	€ 72		**€ 10**		**€ 66**		**€ 9**	

Table 3: Costs for equipment and labour to start and continue with EID (1st and 2nd year) in relation to the size of the flock using either electronic ear tags or ruminal boluses

COSTS FOR READING OF IDENTIFIERS

Equipment: The figures in the table below illustrate the costs for readers on farm. For flocks of 10 breeding animals no electronic reading device was calculated on farm. Since the type of reading equipment depends more on the herd management applied than on the size, these figures are only tentative. There may be also intensive farmed small flocks for which a static reader may be appropriate or larger flocks for which handheld readers would be sufficient.

Equipment costs Readers for EID / **Flock of**	EID with ruminal boluses or electronic ear tags				
	First year	Second and following years	Depreciated costs		
			First year	Second year	Third year
1000 ewes	€ 2,100	0	€ 700	€ 700	€ 700
500 ewes	€ 1,800	0	€ 600	€ 600	€ 600
100 ewes	€ 300	0	€ 100	€ 100	€ 100
50 ewes	€ 300	0	€ 100	€ 100	€ 100
10 ewes	no reader calculated		no reader calculated		

Table 4: Investment costs for reading equipment for EID

The annual costs for the reading of a flock are summarized below, including labour costs. Reading a conventional ear tag comprises the fixation of the head, reading of the whole 15-digit identification code and writing it on a block note or checking it against a preprinted list. Reading of a batch of slaughter lambs with holding tags (intended for slaughter before the age of 12 months) includes the reading and issuing a movement document.

Costs of electronic readings per year	For a nucleus flock of				
	1000 ewes	500 ewes	100 ewes	50 ewes	10 ewes
1 reading with a handheld reader	€ 128	€ 114	€ 103	€ 101	--
1 reading with a static reader	€ 508	€ 504	--	--	--
10 readings with a handheld reader	€ 378	€ 239	€ 128	€ 114	--
10 readings with a static reader	€ 583	€ 542	--	--	--

Costs of conventional readings per year					
1 reading of conventional 15-digit ear tag	€ 167	€ 83	€ 17	€ 8	€ 1.67
10 readings of conventional 15-digit ear tag	€ 1,667	€ 833	€ 167	€ 83	€ 17

Costs of conventional reading of holding tags (animals intended for slaughter before 12 months						
1 conventional reading	per batch	€ 5.00	€ 5.00	€ 3.33	€ 3.33	€ 3.33
	per head of batch	€ 0.01	€ 0.02	€ 0.06	€ 0.12	€ 0.62

Table 5: Costs for reading of animals identified in relation to the type of reading, the number of readings per year and size of the flock

Per-head costs: As regards the electronic reading, per-head costs for one reading largely depend on how many animals and how often they have to be read. The table below shows the costs per head per reading for 1 and 10 readings a year in comparison to the costs for reading a conventional ear tag.

Costs per reading of animal identified										
Flock size	**1000**		**500**		**100**		**50**		**10**	
EID reading									conventional	
Number of readings/year	1	10	1	10	1	10	1	10	1	10
Reader										
Handheld reader	€ 0.07	€ 0.01	€ 0.14	€ 0.02	€ 0.73	€ 0.09	€ 1.47	€ 0.19		
Static reader	€ 0.37	€ 0.05	€ 0.73	€ 0.09						
Manpower									€ 0.17	€ 0.17
Handheld reader	€ 0.03	€ 0.03	€ 0.03	€ 0.03	€ 0.03	€ 0.03	€ 0.03	€ 0.03		
Static reader	€ 0.01	€ 0.01	€ 0.01	€ 0.01						
Total									**€ 0.17**	**€ 0.17**
Handheld reader	**€ 0.10**	**€ 0. 04**	**€ 0.17**	**€ 0.05**	**€ 0.76**	**€ 0.12**	**€ 1.50**	**€ 0.22**		
Static reader	**€ 0.38**	**€ 0.06**	**€ 0.74**	**€ 0.10**						

Table 6: Per-head costs for one reading of electronically identified animals in relation to the number of readings

The two graphics below illustrate the cut offs from when on electronic reading has a cost advantage compared to a conventional reading. For flocks of 500-1000 animals, electronic reading with a handheld reader would be cheaper than conventional reading from the first reading on. For 100 animals the cut off for electronic reading with a handheld reader would be reached with 7 readings per year and for a 50 head flock at more than 10 readings. For readings with a static reader the cut off for 500-1000 animal flocks would be at around 3 to 6 readings a year.

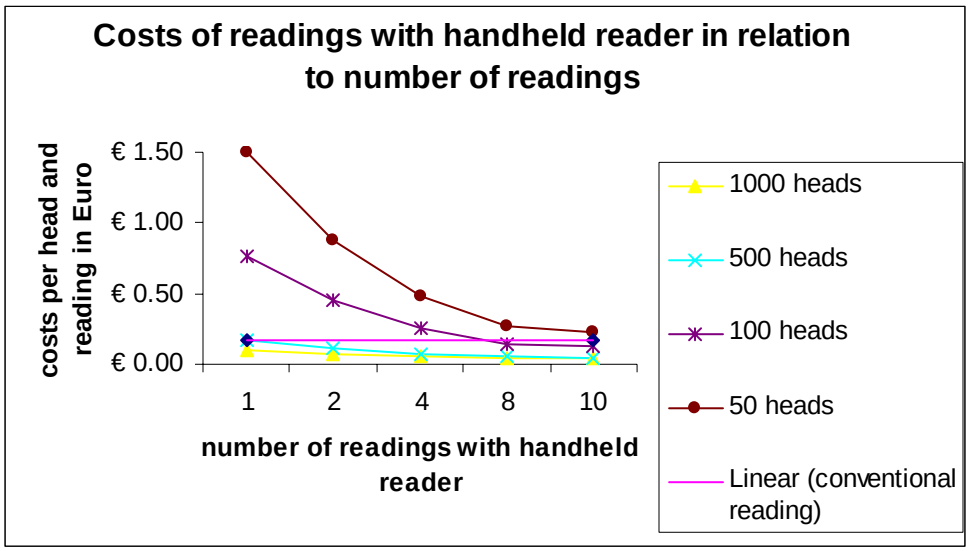

Table 7: Costs per head and reading with a handheld reader of animals electronically identified in relation to the number of readings per year and size of the flock and cut offs with conventional readings

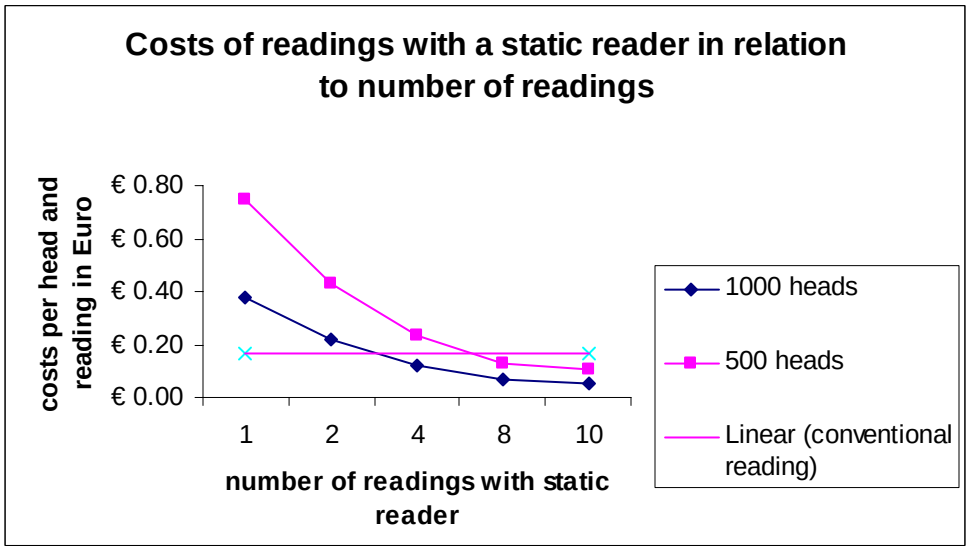

Table 8: Costs per head and reading with a static reader of animals electronically identified in relation to the number of readings per year and size of the flock and cut off with conventional reading

COSTS FOR THE FURTHER PROCESSING OF READINGS

When comparing electronic with conventional reading, additional factors such as further processing of the readings have to be taken into account. The two tables below show the costs and the graphical distribution of the costs of further processing the readings. The cut-off for electronically transferred data is reached between 1 and 2 readings from 1000 heads and between 2 to 3 readings from 500 heads. For smaller flocks of 50 heads a cut-off would be reached with around 40 readings/data transfers per year. If a movement document has to be filled in, additional time would be needed to enter the conventionally read identifiers, whereas in an electronic reading a movement document could be processed containing the individual identifiers.

Costs for data transfer	for number of transfers	1000 heads	500 heads	100 heads	50 heads	10 heads
From handheld reader	1	€ 303	€ 303	€ 303	€ 303	--
	10	€ 333	€ 333	€ 333	€ 333	--
From static reader	1	€ 300	€ 300	--	--	--
	10	€ 300	€ 300	--	--	--
From conventional reading	1	€ 167	€ 83	€ 17	€ 8	€ 1.67
	10	€ 1,667	€ 833	€ 167	€ 83	€ 17

Table 9: Costs for the further handling of read identifiers in relation to the number of transfers per year and size of the flock

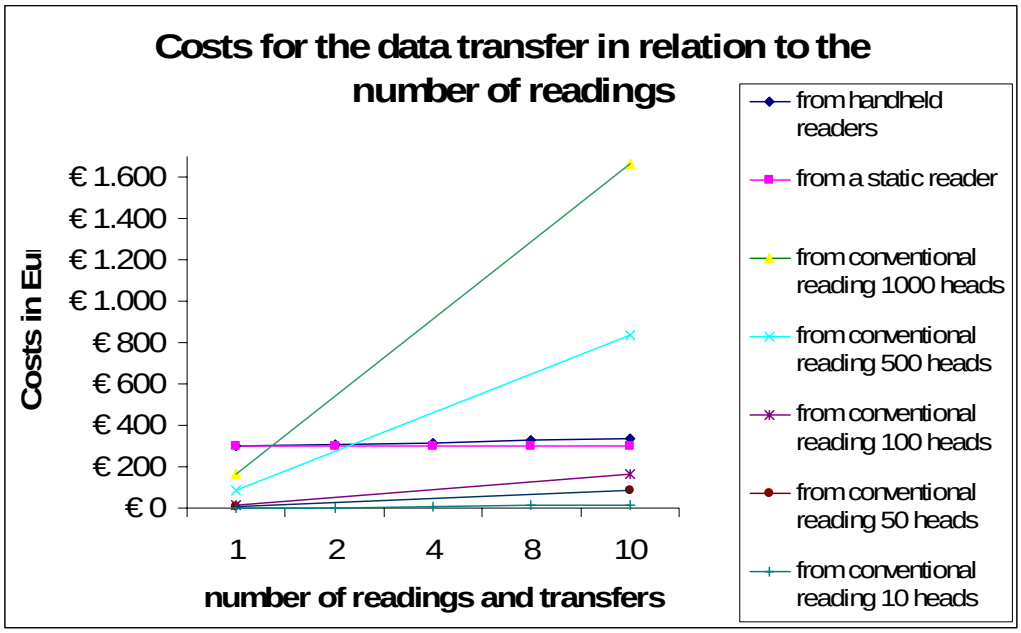

Table 10: Costs for the data transfer of read identifiers in relation to the number of readings/transfers per year and size of the flock

COSTS FOR EID AT OTHER TYPES OF HOLDINGS

Compared to the holding model above where breeding stock and offspring have to be identified and read, other holding types, such as fattening farms, livestock markets or abattoirs mainly receive already identified animals. Those holdings may have mainly costs for the reading of the animals, although at fattening farms some expenses for the retagging may occur. In milk production additional readings may also be required, e.g. when regularly recording milk yields.

In order to set up electronic reading systems, some initial preparatory work may be needed for narrowing or extending existing corridors, to replace some metallic parts around a static reader's antenna by non-metallic materials, to set up connections to weigh scale heads, etc. As the extent of those works will differ widely between individual holdings, these possible additional initial costs can not be calculated.

MILK PRODUCTION

For sheep or goats holdings which are specialized in milk production the above general model largely applies as regards the identification. Such holdings may need to read milking animals

frequently to link recorded milk yields to individual animals. The table below summarizes the costs per animal for frequent readings and data transfers compared to the conventional way to read and transfer the information.

Per-head costs for reading and data processing of animals identified

Flock size	**500**		**100**		**50**		
Type of reader	handheld	static	handheld	static	handheld	static	conventional
10 readings/year	€ 0.12	€ 0.16	€ 0.45	€ 0.79	€ 0.89		€ 0.34
20 readings/year	€ 0.07	€ 0.09	€ 0.22	€ 0.39	€ 0.43		€ 0.34
30 readings/year	€ 0.05	€ 0.06	€ 0.16	€ 0.27	€ 0.29	€ 0.53	€ 0.34
40 readings/year	€ 0.05	€ 0.05	€ 0.13	€ 0.21	€ 0.23	€ 0.40	€ 0.34
50 readings/year	€ 0.04	€ 0.04	€ 0.11	€ 0.17	€ 0.19	€ 0.32	€ 0.34

Table 11: Costs for frequent readings and data transfers per year in relation to size of the flock

FATTENING FARMS

Holdings buying already identified animals for fattening will not have the costs for the initial identification unless animals are brought in from a third country. Depending on the management of the holding readings should be performed of the animals coming onto the holding and leaving the holding for the up-to date holding register. However, when weighing animals during the fattening phase at least two more readings to control the weight gain and to produce defined weight groups for marketing EID could save some 1,800-2,100€ compared to conventional 15-digit ear tag reading per fattening period of 1000 animals. The saving along the production would still be 1,000-1,300€ when taking into account some 740€ of additional costs for the electronic identification at the holding of birth.

Costs for 1000 fattening sheep	with EID (ear tags)	with 15-digit CID ear tags
Retagging 2.5% (~half a year)	~ € 63	~ € 37
4 readings (handheld - static reader)	~ € 200 – 480	~ € 1,336
Data processing	~ € 300 - 313	~ € 1,336
total	**~ € 563 - 856**	**~ € 2,709**

Cost for the identification	with EID (ear tags)	with 15-digit CID ear tags
1000 sheep (2.5% retagging 1/2year)	~ € 1,740	~ € 1,000

Table 12: Costs for 4 readings of 1000 fattening animals when using EID compared to 15-digit CID

LIVESTOCK MARKETS/COLLECTION CENTERS

At livestock markets or collection centers all animals should normally be read at arrival to establish their identity and at departure to allow further tracing. In order to keep track of the activities, all readings should be recorded in the management system of the place. Especially in markets or collection centers where larger numbers of animals have to be read and recorded, the conventional reading of 15-digit ear tags would become a limiting factor. Calculating half a minute per animal, for reading the conventional 15-digit ear tags of 1000 animals within 1 hour there would be more than 8 persons needed to fix the animals, read and note the identification code. Further time is needed to enter the information into a management system and to read them again for dispatch. This action would cost around 500€. Assuming that the annual throughput through a market would be 10,000 animals, two electronic readings of 1000 animals with two static readers would costs some 140€ and each reading would take 25 minutes. In a market with 4,000 animals unloaded per hour, at least 32 persons would be needed for a conventional reading of the 15-digit individual identification of all the animals. The same effort would be required at dispatch.

The table below provides a comparison of EID and conventional reading as per-head costs for 2 readings and data processing for markets with different annual throughput (5000, 10,000 and

100,000 animals). For a market of around 5000 animals per year, 2 handheld readers were calculated, for a market of 10,000 animals both, handheld and static readers and for a market of 100,000 animals 2 static readers were calculated.

Per-head reading costs for a market with a throughput of	with EID (bolus or ear tag)	with 15-digit CID ear tags
5000 animals/year		
2 readings (2 handheld readers)	~ € 0.07	~ € 0.33
Data processing	~ € 0.06	~ € 0.17
total	**~ € 0.13**	**~ € 0.50**
10,000 animals/year		
2 readings (2 handheld readers)	~ € 0.05	~ € 0.33
Data processing	~ € 0.03	~ € 0.17
total	**~ € 0.08**	**~ € 0.50**
2 readings (static reader)	~ € 0.11	~ € 0.33
Data processing	~ € 0.03	~ € 0.17
total	**~ € 0.14**	**~ € 0.50**
100,000 animals/year		
2 readings (static reader)	~ € 0.02	~ € 0.33
Data processing	~ € 0.00	~ € 0.17
total	**~ € 0.02**	**~ € 0.50**

Table 13: Costs for 2 readings per animal in relation to the annual throughput of a market and comparing EID with conventional reading

However, if electronically as well as only conventionally identified batches are received, a market could not take full advantage of an automated reading system. In the case of batches where some animals are not electronically identified, technology is available to allow markets to deal with such exceptions, e.g. automated sorting race.

SLAUGHTERHOUSES

At slaughterhouses the identity of animals has to be established at least at arrival. Similar to livestock markets, the costs for the electronic reading depend on the annual and daily volume of animals to be read. In a smaller slaughterhouse with 1000 small ruminants slaughtered a year and around 25 animals a week the costs per head for handheld reading and data processing would be would be around 0.14€ compared to about 0.34€ when conventionally reading and transferring the reading to a management system. For slaughterhouses with 10,000 to 100,000 small ruminants a year the reading with a static reader would be round 0.06 to 0.01€ per head compared to the 0.34€ for the conventional reading and transfer.

As mentioned for markets, if electronically as well as only conventionally identified batches are received, slaughterhouses could not take full advantage of an automated reading system. In the case of batches where some animals are not electronically identified, technology is available to allow to deal with such exceptions, e.g. automated sorting race.

4. COST ANALYSIS FOR EID AT MEMBER STATE LEVEL

The costs for identification and reading for flocks/farm holdings are calculated on the basis of the model in the chapter above and the information and figures given in Annex II. In these calculations costs for markets/collection centers or slaughterhouses are not included.

COSTS FOR THE IDENTIFICATION

Costs per animal for the identification taking into account the different labour costs and sheep holding structure in the Member States

The table below summarizes for each Member State the total costs per animal (manpower and devices) for the identification of a sheep flock using the average labour costs and sheep flock sizes of each Member State. The costs are calculated for the electronic identification with 1 standard ruminal bolus with 1 conventional ear tag or 1 electronic with 1 conventional ear tag. In parallel, the costs are shown for the re-tagging with an identical identification code and for the conventional tagging as well as for the tagging of slaughter lambs < 12 months with a single holding tag.

Member State	Costs per animal identified						
	Ruminal bolus + CID*)		Electronic ear tag + CID		Holding tag	two CIDs	
	tagging	Re-tagging	tagging	Re-tagging	Art. 4(3)	tagging	Re-tagging
AT	€ 2.35	€ 1.72	€ 1.89	€ 2.65	€ 0.34	€ 1.12	€ 1.65
BE	€ 2.44	€ 1.85	€ 1.98	€ 2.78	€ 0.38	€ 1.21	€ 1.78
BG	€ 1.92	€ 1.12	€ 1.47	€ 2.06	€ 0.14	€ 0.70	€ 1.06
CY	€ 2.09	€ 1.37	€ 1.64	€ 2.30	€ 0.22	€ 0.87	€ 1.30
CZ	€ 2.00	€ 1.23	€ 1.55	€ 2.17	€ 0.17	€ 0.77	€ 1.17
DE	€ 2.37	€ 1.74	€ 1.91	€ 2.67	€ 0.35	€ 1.14	€ 1.67
DK	€ 2.45	€ 1.86	€ 1.99	€ 2.79	€ 0.39	€ 1.22	€ 1.79
EE	€ 1.97	€ 1.19	€ 1.52	€ 2.13	€ 0.16	€0.75	€ 1.13
EL	€ 2.14	€ 1.42	€ 1.68	€ 2.35	€ 0.24	€ 0.91	€ 1.35
ES	€ 2.16	€ 1.46	€ 1.71	€ 2.39	€ 0.25	€ 0.93	€ 1.39
FI	€ 2.35	€ 1.72	€ 1.90	€ 2.65	€ 0.34	€ 1.12	€ 1.65
FR	€ 2.41	€ 1.80	€ 1.95	€ 2.73	€ 0.37	€ 1.18	€ 1.73
HU	€ 1.99	€ 1.23	€ 1.54	€ 2.16	€ 0.17	€ 0.77	€ 1.16
IE**)	€ 2..25	€ 1.59	€ 1.80	€ 2.52	€ 0.29	€ 1.03	€ 1.52
IT	€ 2.28	€ 1.62	€ 1.82	€ 2.55	€ 0.31	€ 1.05	€ 1.55
LT	€ 1.95	€ 1.17	€ 1.50	€ 2.10	€ 0.15	€ 0.73	€ 1.10
LU	€ 2.40	€ 1.80	€ 1.95	€ 2.73	€ 0.36	€ 1.18	€ 1.73
LV	€ 1.94	€ 1.15	€ 1.49	€ 2.08	€ 0.15	€ 0.72	€ 1.08
MT	€ 2.03	€ 1.28	€ 1.58	€ 2.21	€ 0.19	€ 0.81	€ 1.21
NL	€ 2.38	€ 1.77	€ 1.93	€ 2.70	€ 0.36	€ 1.16	€ 1.70
PL	€ 1.98	€ 1.21	€ 1.53	€ 2.14	€ 0.17	€ 0.75	€ 1.14
PT	€ 2.08	€ 1.34	€ 1.62	€ 2.28	€ 0.21	€ 0.85	€ 1.28
RO	€ 1.93	€ 1.13	€ 1.47	€ 2.06	€ 0.14	€ 0.70	€ 1.06
SE	€ 2.44	€ 1.85	€ 1.99	€ 2.78	€ 0.38	€ 1.22	€ 1.78
SI	€ 2.08	€ 1.35	€ 1.63	€ 2.28	€ 0.21	€ 0.86	€ 1.28
SK	€ 1.97	€ 1.20	€ 1.52	€ 2.13	€ 0.16	€ 0.75	€ 1.13
UK	€ 2.34	€ 1.71	€ 1.88	€ 2.64	€ 0.33	€ 1.11	€ 1.64
EU 25 average	**€ 2.25**	**€ 1.59**	**€ 1.80**	**€ 2.52**	**€ 0.29**	**€ 1.03**	**€ 1.52**

***) CID:** conventional 15-digit ear tag
****)** as labour costs were not available the EU25 average labour costs were used

Table 14: Costs per animal for the different means of identification, taking into account the differences in labour costs and average sheep flock sizes in the Member States

Total costs for identifying the national sheep flock of a Member State taking into account its labour costs and average flock sizes

The table below compares the costs for the EID of sheep per Member State with and without using the derogation for animals intended for slaughter before the age of 12 months taking the per-head

costs from above and refers to the initial phase (1st year) when all breeding animals (nucleus flock) and their offspring (others) are electronically identified. The figures are based on the EUROSTAT figures. With more detailed information from the Member States on breeding stock, reproduction rates and animals intended for slaughter before 12 months of age, the model could be adjusted.

Member State	All sheep with EID				EID with derogation Art. 4(3) for slaughter lambs			
	With ruminal boluses		With electronic ear tags		With ruminal boluses		With electronic ear tags	
	Breeding stock	others	Breeding stock	others	Breeding stock	others	Breeding stock	others
AT	€ 494,112	€ 253,622	€ 398,388	€ 198,939	€ 494,111	€ 120,060	€ 398,388	€ 100,681
BE	€ 304,725	€ 66,974	€ 247,843	€ 35,330	€ 304,725	€ 33,077	€ 247,843	€ 28,001
BG	€ 2,512,792	€ 271,590	€ 1,918,369	€ 207,343	€ 2,512,792	€ 120,347	€ 1,918,369	€ 94,393
CY	€ 414,494	€ 118,244	€ 324,498	€ 92,571	€ 414,494	€ 54,713	€ 324,498	€ 44,335
CZ	€ 192,706	€ 105,505	€ 148,908	€ 81,526	€ 192,706	€ 47,736	€ 148,908	€ 38,047
DE	€ 3,808,493	€ 2,440,901	€ 3,075,517	€ 1,971,129	€ 3,808,493	€ 1,190,904	€ 3,075,517	€ 1,000,401
DK	€ 179,145	€ 214,005	€ 145,804	€ 174,176	€ 179,145	€ 105,815	€ 145,804	€ 89,641
EE	€ 73,777	€ 55,579	€ 56,765	€ 42,763	€ 73,777	€ 24,962	€ 56,765	€ 19,784
EL	€ 15,844,754	€ 3,515,573	€ 12,469,717	€ 2,766,733	€ 15,844,754	€ 1,641,362	€ 12,469,717	€ 1,338,556
ES	€ 38,774,412	€ 3,697,982	€ 30,609,928	€ 2,919,321	€ 38,774,412	€ 1,735,707	€ 30,609,928	€ 1,420,773
FI	€ 121,950	€ 83,125	€ 98,332	€ 67,026	€ 121,950	€ 40,453	€ 98,332	€ 33,926
FR	€ 17,407,098	€ 3,777,976	€ 14,113,749	€ 3,063,199	€ 17,407,098	€ 1,855,974	€ 14,113,749	€ 1,565,912
HU	€ 2,159,098	€ 643,859	€ 1,667,022	€ 497,118	€ 2,159,098	€ 290,904	€ 1,667,022	€ 231,617
IE*)	€ 7,931,784	€ 6,136,440	€ 6,330,828	€ 4,897,857	€ 7,931,784	€ 2,934,835	€ 6,330,828	€ 2,830,770
IT	€ 13,814,357	€ 2,120,494	€ 11,056,357	€ 1,697,143	€ 13,814,357	€ 1,018,916	€ 11,056,357	€ 847,458
LT	€ 34,397	€ 39,203	€ 26,392	€ 30,079	€ 34,397	€ 17,522	€ 26,392	€ 13,836
LU	€ 8,029	€ 8,846	€ 6,508	€ 7,171	€ 8,029	€ 4,344	€ 6,508	€ 3,664
LV	€ 50,362	€ 35,768	€ 38,566	€ 27,390	€ 50,362	€ 15,933	€ 38,566	€ 12,548
MT	€ 17,887	€ 4,477	€ 13,890	€ 3,476	€ 17,887	€ 2,043	€ 13,890	€ 1,639
NL	€ 1,545,427	€ 1,702,895	€ 1,250,352	€ 1,377,754	€ 1,545,427	€ 833,510	€ 1,250,352	€ 701,616
PL	€ 404,154	€ 240,599	€ 311,380	€ 185,369	€ 404,154	€ 108,308	€ 311,380	€ 85,995
PT	€ 4,399,655	€ 864,978	€ 3,437,024	€ 675,724	€ 4,399,655	€ 398,766	€ 3,437,024	€ 322,270
RO	€ 12,336,892	€ 2,317,566	€ 9,426,864	€ 1,770,898	€ 12,336,892	€ 1,028,535	€ 9,426,864	€ 807,700
SE	€ 517,595	€ 633,101	€ 421,075	€ 515,043	€ 517,595	€ 312,799	€ 421,075	€ 264,858
SI	€ 175,558	€ 87,623	€ 137,216	€ 68,486	€ 175,558	€ 40,430	€ 137,216	€ 32,695
SK	€ 436,633	€ 169,266	€ 336,105	€ 130,295	€ 436,633	€ 76,081	€ 336,105	€ 60,336
UK**)	€ 37,778,554	€ 44,831,732	€ 30,426,914	€ 36,107,557	€ 37,778,554	€ 17,932,693	€ 30.426.914	€ 14.443.023

***)** as labour costs were not available the EU25 average labour costs were used

****)** under the derogation of Art. 4(3) 22% of offspring where considered for replacement and 78% intended for slaughter before 12 months of age

Table 15: Costs per Member State in the first year for EID of the national sheep flock with ruminal boluses or electronic ear tags with and without using the derogations for animals intended for slaughter before the age of 12 months

In the following years or in the case that in the initial phase the breeding flock born before the implementation date of the EID has not to be identified by EID, costs would occur as shown in the table above in the columns "others" when mainly the offspring has to be tagged.

COSTS FOR THE READING OF IDENTIFIERS

Costs per animal for the reading of the identification, taking into account the different labour costs and sheep flock sizes in the Member States

The table below summarizes for each Member State the total costs per animal (manpower and devices) for reading the EID in a sheep flock using the average labour costs and sheep flock sizes for each Member State. The table compares the costs per head for one and ten readings of the flock a year with a handheld reader and where applicable with a static reader. For flocks of 10 sheep or less, nor electronic reading was calculated, showing the per-head costs for conventional reading.

Per-head costs per reading for animals identified											
Flock size		**500 and more**		**100 - 500**		**50 - 100**		**10 - 50**		**10 or less**	
Number of readings/year*)		1 EID	10 EID	1 EID	10 EID	1 EID	10 EID	1 EID	10 EID	1 CID	10 CID
Member State	**Type of reader**										
AT	Handheld	€ 0,11	€ 0,04	€ 0,18	€ 0,05	€ 0,77	€ 0,13	€ 1,51	€ 0,23	*€ 0,21*	*€ 0,21*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
BE	Handheld	€ 0,12	€ 0,05	€ 0,19	€ 0,06	€ 0,78	€ 0,14	€ 1,51	€ 0,24	*€ 0,25*	*€ 0,25*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
BG	Handheld	€ 0,08	€ 0,01	€ 0,15	€ 0,02	€ 0,74	€ 0,10	€ 1,47	€ 0,20	*€ 0,01*	*€ 0,01*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
CY	Handheld	€ 0,09	€ 0,03	€ 0,16	€ 0,03	€ 0,75	€ 0,11	€ 1,49	€ 0,21	*€ 0,09*	*€ 0,09*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
CZ	Handheld	€ 0,08	€ 0,02	€ 0,16	€ 0,03	€ 0,74	€ 0,10	€ 1,48	€ 0,20	*€ 0,05*	*€ 0,05*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
DE	Handheld	€ 0,11	€ 0,05	€ 0,18	€ 0,06	€ 0,77	€ 0,13	€ 1,51	€ 0,23	*€ 0,22*	*€ 0,22*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
DK	Handheld	€ 0,12	€ 0,05	€ 0,19	€ 0,06	€ 0,78	€ 0,14	€ 1,51	€ 0,24	*€ 0,26*	*€ 0,26*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
EE	Handheld	€ 0,08	€ 0,02	€ 0,15	€ 0,03	€ 0,74	€ 0,10	€ 1,48	€ 0,20	*€ 0,04*	*€ 0,04*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
EL	Handheld	€ 0,09	€ 0,03	€ 0,17	€ 0,04	€ 0,75	€ 0,12	€ 1,49	€ 0,21	*€ 0,11*	*€ 0,11*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
ES	Handheld	€ 0,09	€ 0,03	€ 0,17	€ 0,04	€ 0,76	€ 0,12	€ 1,49	€ 0,21	*€ 0,12*	*€ 0,12*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
FI	Handheld	€ 0,11	€ 0,04	€ 0,18	€ 0,05	€ 0,77	€ 0,13	€ 1,51	€ 0,23	*€ 0,21*	*€ 0,21*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
FR	Handheld	€ 0,11	€ 0,05	€ 0,19	€ 0,06	€ 0,77	€ 0,14	€ 1,51	€ 0,23	*€ 0,24*	*€ 0,24*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
HU	Handheld	€ 0,08	€ 0,02	€ 0,15	€ 0,03	€ 0,74	€ 0,10	€ 1,48	€ 0,20	*€ 0,05*	*€ 0,05*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
IE**)	Handheld	€ 0.10	€ 0. 04	€ 0.17	€ 0.05	€ 0.76	€ 0.12	€ 1.50	€ 0.22	*€ 0.17*	*€ 0.17*
	Static	€ 0.38	€ 0.06	€ 0.74	€ 0.10						
IT	Handheld	€ 0,10	€ 0,04	€ 0,18	€ 0,05	€ 0,77	€ 0,13	€ 1,50	€ 0,22	*€ 0,18*	*€ 0,18*
	Static	€ 0,38	€ 0,06	€ 0,74	€ 0,11						
LT	Handheld	€ 0,08	€ 0,01	€ 0,15	€ 0,02	€ 0,74	€ 0,10	€ 1,48	€ 0,20	*€ 0,03*	*€ 0,03*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
LU	Handheld	€ 0,11	€ 0,05	€ 0,19	€ 0,06	€ 0,77	€ 0,14	€ 1,51	€ 0,23	*€ 0,24*	*€ 0,24*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
LV	Handheld	€ 0,08	€ 0,01	€ 0,15	€ 0,02	€ 0,74	€ 0,10	€ 1,47	€ 0,20	*€ 0,02*	*€ 0,02*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
MT	Handheld	€ 0,08	€ 0,02	€ 0,16	€ 0,03	€ 0,75	€ 0,11	€ 1,48	€ 0,20	*€ 0,06*	*€ 0,06*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
NL	Handheld	€ 0,11	€ 0,05	€ 0,18	€ 0,06	€ 0,77	€ 0,13	€ 1,51	€ 0,23	*€ 0,23*	*€ 0,23*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
PL	Handheld	€ 0,08	€ 0,02	€ 0,15	€ 0,03	€ 0,74	€ 0,10	€ 1,48	€ 0,20	*€ 0,04*	*€ 0,04*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
PT	Handheld	€ 0,09	€ 0,02	€ 0,16	€ 0,03	€ 0,75	€ 0,11	€ 1,48	€ 0,21	*€ 0,09*	*€ 0,09*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
RO	Handheld	€ 0,08	€ 0,01	€ 0,15	€ 0,02	€ 0,74	€ 0,10	€ 1,47	€ 0,20	*€ 0,01*	*€ 0,01*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
SE	Handheld	€ 0,12	€ 0,05	€ 0,19	€ 0,06	€ 0,78	€ 0,14	€ 1,51	€ 0,24	*€ 0,25*	*€ 0,25*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
SI	Handheld	€ 0,09	€ 0,02	€ 0,16	€ 0,03	€ 0,75	€ 0,11	€ 1,49	€ 0,21	*€ 0,09*	*€ 0,09*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
SK	Handheld	€ 0,08	€ 0,02	€ 0,15	€ 0,03	€ 0,74	€ 0,10	€ 1,48	€ 0,20	*€ 0,04*	*€ 0,04*
	Static	€ 0,37	€ 0,05	€ 0,74	€ 0,10						
UK	Handheld	€ 0,11	€ 0,04	€ 0,18	€ 0,05	€ 0,77	€ 0,13	€ 1,50	€ 0,23	*€ 0,21*	*€ 0,21*
	Static	€ 0,38	€ 0,06	€ 0,75	€ 0,11						
EU 25 average	Handheld	**€ 0.10**	**€ 0. 04**	**€ 0.17**	**€ 0.05**	**€ 0.76**	**€ 0.12**	**€ 1.50**	**€ 0.22**	***€ 0.17***	***€ 0.17***
	Static	**€ 0.38**	**€ 0.06**	**€ 0.74**	**€ 0.10**						

*) 1EID = 1 reading of EID/year, 10 EID = 10 readings of EID/year, 1 CID = 1 conventional reading/year, 10 CID = 10 conventional readings/year
****)** as labour costs were not available the EU25 average labour costs were used

Table 16 Per-head costs for reading of electronically identified animals in relation to the number of readings, taking into account the differences in labour costs and average sheep flock sizes in the Member States

5. BENEFITS OF EID

Electronic identification has also impacts which lead to benefits. Benefits can be identified in the following areas:

- Benefits for the individual holding
- Benefits for the official controls
- Benefits for the sheep/goat sector as a whole
- Benefits for the food chain and consumer

Benefits for the individual holding

Although the intention of Regulation (EC) 21/2004 is to introduce EID for official identification purpose, holdings could take advantage of it in the herd management.

The benefits largely depend on the degree of herd management and size of the flock. In general, as higher the degree of herd management and flock size, as more prominent is the benefit EID would bring.

Time savings in reading identifiers: With the introduction of the individual identification of small ruminants the conventional reading of the identifiers became a time consuming exercise. Especially for a larger flock conventional reading could become a time constraint. Reading and taking note of individual identification numbers of 1000 animals could take 8 hours or more. To enter the noted 1000 individual identifiers into a herd register or management system would take another 8 hours or more. The table below shows the costs per animal when reading all animals 1 or 10 times a year in comparison to the costs of conventional readings. Despite the costs of the reading equipment, cost savings are due to the time savings an automated reading brings. For smaller flocks electronic reading brings financial benefits only if the flock has to be read more than 10 times a year. Depending on the management needs for reading young lambs, electronic ear tags may have an advantage compared to standard ruminal boluses as they can be applied in younger lambs.

Nucleus flock of		**1000 heads**	**500 heads**	**100 heads**	**50 heads**	**10 heads**
Reading flock with a	**Readings per years**	costs/ animal	costs/ animal	costs/ animal	costs/ animal	costs/ animal
handheld reader	1	**€ 0.10**	**€ 0.17**	**€ 0.76**	**€ 1.50**	--
	10	**€ 0.04**	**€ 0.05**	**€ 0.12**	**€ 0.22**	--
static reader	1	**€ 0.38**	**€ 0.74**	--	--	--
	10	**€ 0.06**	**€ 0.10**	--	--	--
conventional reading	1	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**
	10	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**

Table 17 Reading costs for handheld, static and conventional readings in relation to the number of readings (each animal read 1 and 10 times a year)

In a study on fattening lambs [(3)] it was calculated that when marketing defined quality lots (40-45kg) a plus of 0.10€/kg live weight could be realized. For a group of 180 animals with 2 automated weighing this would create additional profits of 540€.

Automated recording and documentation: Beside time savings in the reading of animals, electronic identification allows to link and record additional information to a read animal, such

as weights, milk yields, interventions and treatments, breeding data. Such information colleted in the field can be entered into herd management systems or holding register and would be again available in the field by uploading the data from the computer. The issuing of movement documents containing individual identifiers can be automated.

Nucleus flock of		**1000 heads**	**500 heads**	**100 heads**	**50 heads**	**10 heads**
Processing readings from a	**Readings/ transfers per years**	costs/ animal	costs/ animal	costs/ animal	costs/ animal	costs/ animal
handheld reader	1	**€ 0.30**	**€ 0.61**	**€ 3.03**	**€ 6.07**	--
	10	**€ 0.03**	**€ 0.07**	**€ 0.33**	**€ 0.67**	--
static reader	1	**€ 0.30**	**€ 0.60**	--	--	--
	10	**€ 0.03**	**€ 0.06**	--	--	--
conventional reading	1	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**
	10	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**	**€ 0.17**

Table 18 Costs for information from a read animal transferred to a record in relation to the number of readings (1 and 10 times a year)

Unambiguously identified animals: The identification and registration requirements of Regulation (EC) 21/2004 take account of the risks experienced in the past of loosing track of the history of an animal due to lost or ineligible identification or incorrectly recorded identification. Electronic identification improves the eligibility and recording of the identification code of individual animals, which is in particular important working with breeding animals or when transferring individual numbers onto a record or document.

Beside the benefits which can be achieved by applying the minimum EID requirements of Regulation (EC) 21/2004, additional benefits could be expected for individual holdings in Member States which will introduce individual movement notifications. In these cases the obligation to keep up-dated holding registers and issue movement documents could be derogated.

Benefits for the official controls

The benefits described in the chapter above for individual holdings apply as well for the official controls of holdings. Whenever competent authorities have to establish the identity of an animal, unambiguous identification, fast reading and automated documentation increases their efficiency. In particular in the case of a disease suspicion or outbreak faster tracing of animals and their movements can reduce the time for actions and the risks of spreading. Having faster control over an outbreak increases the chances to keep it confined and to avoid restrictions for larger areas/regions and to limit the EU financial expenditures for disease control. The FMD crisis of 2001 alone caused expenditures of 2,693 Mio €, of which 1,616 Mio € were claimed for Community reimbursement. One of the main reasons for the extent of the outbreak was the incomplete identification and inadequate tracing of animals (Special Report 8/2004 of the Court of Accounts) [(4)].

The advantages of faster controls are shown on an example for checks in relation to identification and registration as required by Commission Regulation (EC) 1505/2006 of 11 October 2006, in particular Article 2 and 5 thereof. EID allows a more automated control of the individual animals' identification and the herd register. For a flock of 431 sheep time and

accuracy of the checks of conventional identifiers (ear tags or tattoos in 115 animals = 26% of flock) are compared with checks of electronic devices (ruminal bolus).

	Controls with conventional identifiers (2 person team)	**Automated controls with EID (1 person)**
Flock counting	6 minutes	7 - 8 minutes per run
Check of identifiers of individual animals	118 minutes (26% of animals)	automatically done for 100% of animals with flock counting
Herd register control	60 minutes	automatically done at flock counting (herd register preloaded onto the reader for an automated comparison and update)
Control of movement documents	30 minutes	30 minutes
Total time (labour costs 20 €/h)	**214 minutes** 2x ~61 € = **122 €**	**37 - 38 minutes** **~ 12.5 €**

Table 19 Costs for checks of competent authorities in a holding regarding identification and registration and comparing conventional checks with electronic reading of EID

The automated checks of electronically identified animals provide a higher accuracy (the identification of all animals is checked and compared with the electronic herd register) and a considerable saving in time. The time savings are higher as bigger the herd/flock is.

The competent authorities in a region in Italy, where the electronic identification of all bovines continued since the start of the IDEA project, estimate that the time savings in their controls at farms and slaughterhouses are around 45% [(5)] due to the following factors:

- Faster reading of the identifiers
- Decrease of errors and doubts on the identity and registration of animals (errors less than 0.1%).

Although in conformity with Regulation EC) 21/2004, the derogation for the identification of animals intended for slaughter before the age of 12 months and not notifying the individual identification of animals moved within a Member State reduces the benefits of EID for disease control.

Benefits for the sector – added value regarding market advantages and risk reduction for the sheep/goat sector as a whole in connection with animal diseases

Regulation (EC) 178/2002 requires amongst others that traceability of food producing-animals and food is established at all stages of production, processing and distribution. EID helps achieving this aim on the level of individual animals.

The documentation throughout the production chain containing individual animal identification increases the transparency for quality labels and defined product requirements (e.g. regarding feeding, holding and animal welfare conditions). Given the consumer demands, marketing advantages can also be seen if the sector can demonstrate a product tracing (reliable control over the origin and flow of animals and products thereof).

As frequently experienced, outbreaks of certain animal diseases are followed by movement or marketing restrictions which are imposed on whole regions or Member States if there are indications that the authorities cannot contain the disease with less stringent means. Such outbreaks often also provoke import restrictions imposed by third countries on animals and products from a Member State or even from the Community as a whole (e.g. during the BSE crisis). Those restrictions affect animal holdings but also the food industry downstream (meat or milk processing) and the direct and indirect costs/losses can mount easily into the billions of

Euro. The 2001 FMD epidemic had a significant impact on animal husbandry in the whole of the EU as stated by the Court of Accounts in its Special Report 8/2004 [(4)].

Frequently one of the reasons that a disease can spread further despite the containment measures is the difficulty for the authorities to properly trace back animals and their movements leading to the consequences mentioned above. Unclear movements and time consuming tracing exercises hinder the authorities' efforts to swiftly restrict further contacts and to apply to contact holdings containment measures.

Although difficult to quantify, an improved identification with more effective and efficient traceability reduce on the one side the risk and extent (time and area) of movement and export restriction for the sector and on the other side allows faster access to markets if the absence of the disease can be better demonstrated. This is in particular valid for diseases where individual animals have to be traced, such as Brucellosis, Bluetongue disease or Scrapie.

Benefits along the production and food chain and for consumers

At livestock markets, collection centers and abattoirs the identity of all animals have to be established. With the requirement of Regulation (EC) 21/2004 to have an individual identification of each animal it is not sufficient to verify the last 3 or 6 digits of an ear tag. As already calculated for a large flock, to read from 1000 animals the conventional 15-digit ear tag it could take more than 8 hours. In particular in larger establishments where within short times large numbers of animals have to be unloaded or loaded, electronic readings would shorten the time for the identity checks. From JRC's experience, some 400-600 animals could be read within 10 minutes. When the derogations for animals intended for slaughter before the age of 12 months are applied, the establishments would have to cater for both, electronic reading and conventional checks.

In markets or collection centers, beside the time saving for the identity checks, the recorded readings could also be used in the management system to establish e.g. batch lists, sales and movement documents, invoices and records. In abattoirs, the recorded readings could be integrated in the management system to establish kill sequences, to transfer the identity of the animal onto the carcass as a numeric, bar code or electronic label. It would also allow to provide the keeper with details of the grading and to manage keeper payments. From discussions it became evident that most keepers would be interested to get a detailed feedback on the grading allowing them to better select their slaughter animals for optimized performance. Since the majority of slaughtering is in animals under 1 year of age, the derogations for this category would reduce substantially the benefits of electronic identification for abattoirs.

EID would allow with an improved tracing of individual animals throughout the production chain more reliable sourcing of animals and carcasses for further processing. It would enable informed decisions for the consumers. Although in conformity with Regulation EC) 21/2004, the derogation for the identification of animals intended for slaughter before the age of 12 months within a Member State would reduce the possibility for reliable sourcing and trusted and detailed information of consumers.

Many of the above benefits can not be quantified in monetary form, e.g. the reduced errors in identification, the reduced risks of movement and export restrictions. However, an improved identification system such as EID could strongly contribute reducing the expenditures for control of animal disease outbreaks. Other benefits, such as marketing advantages may not directly result in a

better price for a product but most likely in a better acceptability by consumers when information on the origin of a product (e.g. cut) can be provided.

6. CONCLUSIONS

EID brings undoubtedly costs for all sectors from birth to slaughter or disposal of small ruminants. The direct costs occurring in terms of investments for equipment and manpower affect different sectors and are not evenly distributed throughout the production chain from holding of birth until slaughter or disposal. The table below gives an overview on how the sectors are involved.

Type of costs	Type of material/service	Sectors in the chain affected	quantifiable
Identification equipments	Conventional identifiers, electronic identifiers, slaughter tags (Art. 4.3)	Holding of birth, to less extent in other holdings when identifiers are lost (retagging)	yes
	Applicators for identifiers	Holding of birth, to less extent in other holdings when identifiers are lost (retagging)	yes
Reading equipment	Reading devices	All types of holding with the exception of very small holdings	yes
		Official control bodies	yes
	Additional material for reading (e.g. corridor)	All holdings with higher numbers of animals to be read	no
	Data processing equipment (facultative)	For holding which want to make use of the electronic processing of read identifiers	yes
Recovery	Material for recovering EID	Slaughterhouses, rendering plants	no
Man power	Applying identifiers	Holding of birth, to less extent in other holdings when identifiers are lost (retagging)	yes
	Reading identifiers	All types of holding wit the exception of very small holdings	yes
		Official control bodies	yes
	Data processing (facultative)	For holdings which want to make use of the electronic processing of read identifiers	yes
		Official control bodies	yes
	Recovering EID	Slaughterhouses, rendering plants	no

Table 20: Type of costs and their distribution along the production chain

The actual costs for electronic identifiers (standard ruminal boluses, electronic ear tags) are around 1.7 to 2.2 times above the costs for conventional ear tags. However, a decrease of costs for electronic identifiers has been observed and is further expected. The largest expenses in terms of per-head costs occur at the holding of birth. Other types of holdings, especially markets and abattoirs will have costs but also direct advantages in form of automation of readings when comparing per-head costs of 0.02€-0.07€ for electronic reading with 0.17€ per conventional reading. In establishments where large numbers of animals have to be read within short time the individual identification is only feasible with electronic means of identification and reading.

But also for the holding types which have the burden of the identification, EID could bring benefits which equalize or surpass the costs when not only applying EID as a means of official identification but also using it as a management tool.

- For a flock of 1000 ewes in which all breeding animals have to be read ten times a year, despite the costs for electronic identification, reading and processing of the readings would be in the first year between 2,700€ - 3,500€ compared to 4,300€ for conventional readings. In the following years the difference would be even higher as the nucleus herd has only to be identified in the first year. In a flock of 500 ewes the saving in the first year could be up to 800€.
- For flocks of 100 ewes the costs for the EID would be equalized in the first year when breeding animals have to be read around 20 times a year.

- For a flock of 10 or 50 breeding ewes the costs for reading and processing EID is much higher than for conventional identification due to the equipment costs. With models where the readers and other devices are e.g. shared in an association or cooperative or provided from third parties (e.g. transporters, farmer advisory bodies) the costs for EID could become competitive.

The added value of EID can not only be seen in terms of direct monetary benefits. Individual identification will generate a number of benefits for the official controls and the food chain regarding traceability of animals and products for disease controls, save sourcing and quality systems with effects on risk reduction and market advantages for small ruminants and products thereof.

However, the full advantages of EID along the whole production chain can only be achieved if all animals are electronically identified. The derogation from EID for animals intended for slaughter before the age of 12 months would save costs for the holdings of birth but would hinder livestock markets and slaughterhouses to take full advantage of an automated reading of the identification as they have than to cater for both, batches of animals electronically identified and not electronically identified. Also the advantages of EID regarding official controls, traceability, farm management and consumer information would be only partially available.

As the proper individual identification contributes to advantages downstream in terms of market advantages, consumer information and protection it might be considered how to consistently distribute the costs for EID throughout the chain, including all benefiting actors.

REFERENCES

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(4) Court of Accounts, Special report 8/2004 on the Commission management and supervision of the measures to control FMD and the related expenditures

(5) Region of Val d'Aosta, veterinary service - Presentation during an EID workshop in Sibiu, Romania, 15-16 November 2004

(6) EUROSTAT agricultural statistics 20005, http://epp.eurostat.ec.europa.eu

ANNEX I COST MODEL AND BASIC ASSUMPTIONS FOR THE COST ANALYSIS

In order to create a cost model which may be applicable to most of the Member States the analysis is based on following assumptions at holding level:

- **Flock structure:** breeding flocks of 10. 50. 100. 500 and 1000 ewes in reproduction, with a reproduction rate of 90% per year (annually born lambs/kids). From the annually produced lambs/kids the model considers 22% to be kept on farm for replacement of older ewes/goats. 60% to be sent for slaughter within an age of 12 months and 18% to be sold under the condition that they are not intended for slaughter before the age of 12 months. For simplification, in this model only one production cycle per ewe and year is assumed. For the same reason, the loss rate in the first 6 months after birth is assumed to equalize the twin birth rate. Both assumptions may be applicable only for certain breeds and farming conditions.

Nucleus flock (ewes)		**10 heads**	**50 heads**	**100 heads**	**500 heads**	**1000 heads**
Reproduction rate	*90%*	9	45	90	450	900
For replacement	*22%*	2	10	20	99	198
Sold for slaughter < 12 months of age	*60%*	5.4	27	54	270	540
Sold not for slaughter < 12 months of age	*18%*	1.6	8	16	81	162
Total lambs/kids	***100%***	**9**	**45**	**90**	**450**	**900**

Table AI-1: Farm structures used in the general cost model

For the individual Member States, the herd structures were based on the data provided by EUROSTAT. For a coherent approach in the cost calculations for the individual Member States EUROSTAT figures for the number of farm holdings, breeding animals and other animals were used, where breeding animals were considered the nucleus flock and from the other animals 22% were considered as replacement animals, 60% as slaughter lambs (<12months) and 18% as breeding lambs. For the UK 22% of others were considered for replacement and 78% as slaughter lambs (<12 months).

- **Costs for the identification equipment:** For the identifiers the costs are based on average prices obtained from manufacturers and suppliers as well as from recent calls for tender in some Member States which already included the delivery costs and training. For compatibility between prices in different Member States the prices are given without VAT. The price for boluses refers to standard ruminal boluses (ceramic capsule. ~75 grams. ~70mm length). The conventional ear tags and the electronic identifier are considered to have the same code in compliance with Regulation 21/2004 (2-letter or 3-digit country code and an individual code of 12 digits). If only ear tags are used, electronic and conventional ear tag come in pairs and have to be applied either with the same or different pliers (applicators). In the model it is considered that two different pliers have to be used. From the experience gained, applicators for electronic and conventional identifiers have to be replaced after tagging of around 1000 animals. From the experience in the IDEA project and from Member States using already EID the retagging rate for ruminal boluses is around 0.1% per year (lost or not functioning), whereas for conventional and electronic ear tags the loss rate varies considerably (between 0.1 and 14% per year). In the cost model the average retagging rate is set to

5 % per year. If for retagging an identical code is used, the identifiers for retagging are calculated to be around three times more expensive (including delivery).

Initial identification	price	retagging	price
EID standard **ruminal bolus**	1.50 €	**Ruminal bolus** for retagging	4.50 €
EID **electronic ear tag**	1.00 €	**Electronic ear tag** for retagging	3.00 €
Conventional individual **ear tag**	0.30 €	Conventional **ear tag** for retagging	1.00 €
Holding ear tag for slaughter lambs	0.10 €	**Holding ear tag** for slaughter lambs	0.10 €
Applicator for ruminal boluses	20 €	Cost per head (to be replaced after some 1000 animals)	0.02 €/head
Applicator for ear tags (electronic and conventional)	20 €	Cost per head (to be replaced after some 1000 animals)	0.02 €/head

Retagging rate for ruminal boluses	0.1 %
Retagging rate for conventional and electronic ear tags	5 %

Table AI-2: Average prices used in the cost model for the identification equipment (identifiers. applicators) and retagging rates

Costs for the reading equipment: For the reading of EID identifiers the costs of the readers are based on average prices obtained from manufacturers and suppliers as well as from recent calls for tender in some Member States. The depreciation of readers is calculated for a period of 3 years to show the annual costs for such equipment. For compatibility between prices in different Member States the prices are given without VAT. Commonly available reading equipment on the market can be either handheld readers or a static reader (to be fixed to a pathway or corridor). Handheld readers may directly display the identification code and store it in the memory of the reader from where the information can be downloaded or a previous list of readings can be uploaded onto the reader. For handheld readers the price is for a model with the necessary software and a memory allowing entering additional data and up- and downloading data to and from a computer. To make most advantage of a handheld reader a computer with appropriate software should be used. A static reader has always to be linked to a computer to visualize and store the readings.

- In each holding, with the exception of very small holdings, in the model at least one handheld reader is considered. In addition, for flocks of 500 or more ewes. a static reader is included in the calculations and for flocks of 1000 ewes a second handheld reader (see overview below).

Reading equipment	price		Annual costs (depreciation)	
Handheld reader	300 €		Depreciation over 3 years =	100 €/year
Static reader (fixed reader)	1,500 €		Depreciation over 3 years =	500 €/year

Number of readers per holding (suggestion)	10 heads	50 heads	100 heads	500 heads	1000 heads
Handheld reader	0	**1**	**1**	**1**	**2**
Static reader	0	0	0	**1**	**1**

Table AI-3: Average prices and number of devices used in the cost model for EID reading equipment

- **Costs for human resources for tagging and reading animals:** The costs for man power are based on the EUROSTAT statistical survey for 2004 which shows for the EU (25 countries) an average of 21.19 €/hour with a lower and upper range of 2.24 € and 30.70 € between the Member States. In the general cost model average costs of 20 € per hour are calculated for man power.

  Tagging: From the experience gained in field work it takes a trained and experienced person in average 1 minute to apply a double identification (a ruminal bolus + conventional ear tag or an electronic + a conventional ear tag). In the same time two lambs could be tagged with a holding tag.

For retagging 1.5 minutes are considered for retagging with an identical electronic ear tag. The same time is needed for verifying that a bolus can not be read and for applying a replacement bolus.

Readings: With a static reader fixed to an appropriate corridor some 100 animals can be read within 2.5 minutes. With a handheld reader it would take on average some 5 seconds to read an electronic ear tag or bolus and some 30 seconds to read a conventional 15-digit ear tag manually and write it down on a note block or list. For animals identified with a holding ear-tag (animals slaughtered before the age of 12 months) the time needed for reading the identifiers and issuing a movement document is set to 10-15 minutes and remaining rather constant irrespectively of the size of the batch to be read.

Costs for tagging and reading animals and data processing	unit	price
Man power	1 hour	20.00 €
Tagging time (ruminal bolus + conventional tag or electronic + conventional tag)	1 animal/minute = 0.016 hours	0.33 €
Tagging time for lambs to be slaughtered before 12 months of age	2 animals/minute = 0.0083 hours	0.17 €
Average reading time with a static reader (dynamic reading of 100 animals)	2.5 minutes = 0.0416 hours	0.83 €
Average reading time with a handheld reader	5 seconds = 0.00138 hours	0.03 €
Average reading time to read a conventional 15-digit ear tag manually	0.5 minutes = 0.0083 hours	0.17 €
Average time for reading and document issuing for slaughter lambs with holding number	10-15 minutes = 0.16 – 0.25 hours	3.33 - 5.00 €
Average upload or download time from a handheld reader to a computer and vice versa	5 minutes = 0.083 hours	1.67 €
Average time to transfer the code of a conventional 15-digit ear tag manually from the notes to a register	0.5 minutes = 0.0083 hours	0.17 €

Table AI-4: Average time and prices used in the cost model for the tagging animals, reading and processing read data

Reading frequency: In the model the reading costs are based on the assumption that the nucleus flock is at least read once a year for the annual inventory and all other categories (replaced breeding animals and offspring) at least once when moved off holding. Since the reading devices may be relatively expensive (costs) but the time savings could be high compared to conventional reading (benefits) the per-head reading costs are calculated for different reading frequencies.

Number of readings of EID in a flock of		10 ewes	50 ewes	100 ewes	500 ewes	1000 ewes
Nucleus flock	with **handheld** reader	-	**1&10**	**1&10**	**1&10**	**1&10**
	with **static** reader	-	-	-	**1&10**	**1&10**
Electronically identified animals moved off farm	with **handheld** reader	-	**1**	**1**	**1**	**1**
	with **static** reader	-	-	-	**1**	**1**
Animals intended for slaughter <12months	**conventional** reading	**1**	**1**	**1**	**1**	**1**

Table AI-5: Number of readings of animals of a flock used in the model for the calculation of cost for manpower

Data transfer for further processing: From the experience it would not take more than about 5 minutes to download the readings from a handheld reader to a computer, irrespectively how many animal identifiers are in the file to transfer. The same time would be needed for the upload of a prelist from a computerized file to the reader. For each reading of the flock one up and one downloading step is calculated. A static reader is normally directly connected to a computer. Therefore no additional time is calculated for the data exchange. For issuing of a movement document no additional time is taken into account as the data could be electronically transferred and printed to a document. Some 30 seconds are calculated to transfer a read a conventional 15-digit ear tag manually from a note block or list into a register.

- **Costs for the equipment to process read identifiers:** Facultative, the keeper could send or download the read data to a weight scale head, an electronic herd register or management system and vice versa, irrespectively if handheld or static readers are used. For this operation a computer (e.g. PC. laptop. PDA) and software which can communicate with the reader's software are necessary. To automate also documents, such as movement documents or lists, requires in addition a printer. Based on average prices, the costs for computer, software and printer are calculated together with 900€ and a depreciation of 3 years (see overview below). For compatibility between prices in different Member States the prices are given without VAT.

Data processing equipment	price		Annual costs (depreciation)	
Computer. software. printer	900 €		Depreciation over 3 years =	300 €/year

Table AI-6: Average price and depreciation used in the cost model for data processing equipment

ANNEX II OVERVIEW ON LABOUR COSTS AND THE SHEEP HOLDING STRUCTURE IN THE MEMBER STATES

Overview on labour costs and the sheep holding structure in the Member States as given by EUROSTAT [6]

Member State	Labour cost/hour	Average size and number of sheep holdings in the following categories									
		500 heads or more		100 to 500 heads		50 to 100 heads		10 to 50 heads		10 heads or less	
	EUROSTAT 2004	size	holdings	size	holdings	size	holdings	size	holdings	size	holdings
AT	€ 25.30	837	10	173	360	66	930	21	7,280	5	6,160
BE	€ 30.29	750	30	174	300	68	440	22	1,820	5	1,470
BG	€ 1.45	924	50	155	1,600	66	2,150	17	24,660	4	147,730
CY	€ 11.10	787	110	221	610	73	270	25	520	5	100
CZ	€ 5.85	1,105	20	193	250	69	320	21	2,060	5	2,890
DE	€ 26.22	1,016	1,360	219	2,990	69	3,640	25	12,650	5	9,680
DK	€ 30.70	875	50	186	280	68	410	23	1,430	5	890
EE	€ 4.24	620	10	188	90	72	140	20	1,210	4	1,740
EL	€ 13.37 *)	666	1,360	199	28,890	68	16,940	23	49,290	4	31,450
ES	€ 14.76	977	12,690	260	23,350	70	8,500	24	21,120	5	19,580
FI	€ 25.34	480	10	191	240	70	240	25	720	4	510
FR	€ 28.46	787	4,600	246	16,240	69	7,800	23	24,450	5	19,800
HU	€ 5.54	1,026	610	232	2,210	72	1,340	22	5,590	4	12,100
IE	not available	771	1,960	207	17,610	71	10,310	30	11,370	5	1,130
IT	€ 21.39	744	2,600	228	17,350	67	7,320	21	24,780	4	22,820
LT	€ 3.22	0	0	159	10	71	60	17	1,080	5	2,880
LU	€ 28.33	0	0	198	10	65	30	22	120	4	110
LV	€ 2.52	0	0	148	50	64	80	19	950	4	3,510
MT	€ 7.77	0	0	104	10	59	30	16	330	4	680
NL	€ 27.23	879	350	193	3,490	71	3,240	28	5,100	5	2,180
PL	€ 4.74	894	30	170	600	68	860	21	4,800	4	9,820
PT	€ 10.20	852	850	204	5,350	68	3,260	20	18,470	5	28,030
RO	€ 1.76	887	1,010	194	13,060	67	13,600	17	103,400	4	355,460
SE	€ 30.43 *)	767	80	188	1,080	69	1,440	26	3,940	5	1,120
SI	€ 10.41	0	0	163	160	67	400	21	3,060	5	2,120
SK	€ 4.41	993	180	273	380	66	110	21	560	4	1,430
UK	€ 24.71	1,299	20,830	244	29,130	72	9,920	26	15,260	5	7,830
EU 25 average	€ 21.19	**701**		**197**		**68**		**22**		**4**	

*) only labour costs for 2003 available

Table AII-1: Overview table regarding labour costs and average size of sheep holdings and number of holdings per size categories

Graphic overview on the national flock structures for sheep in the Member States

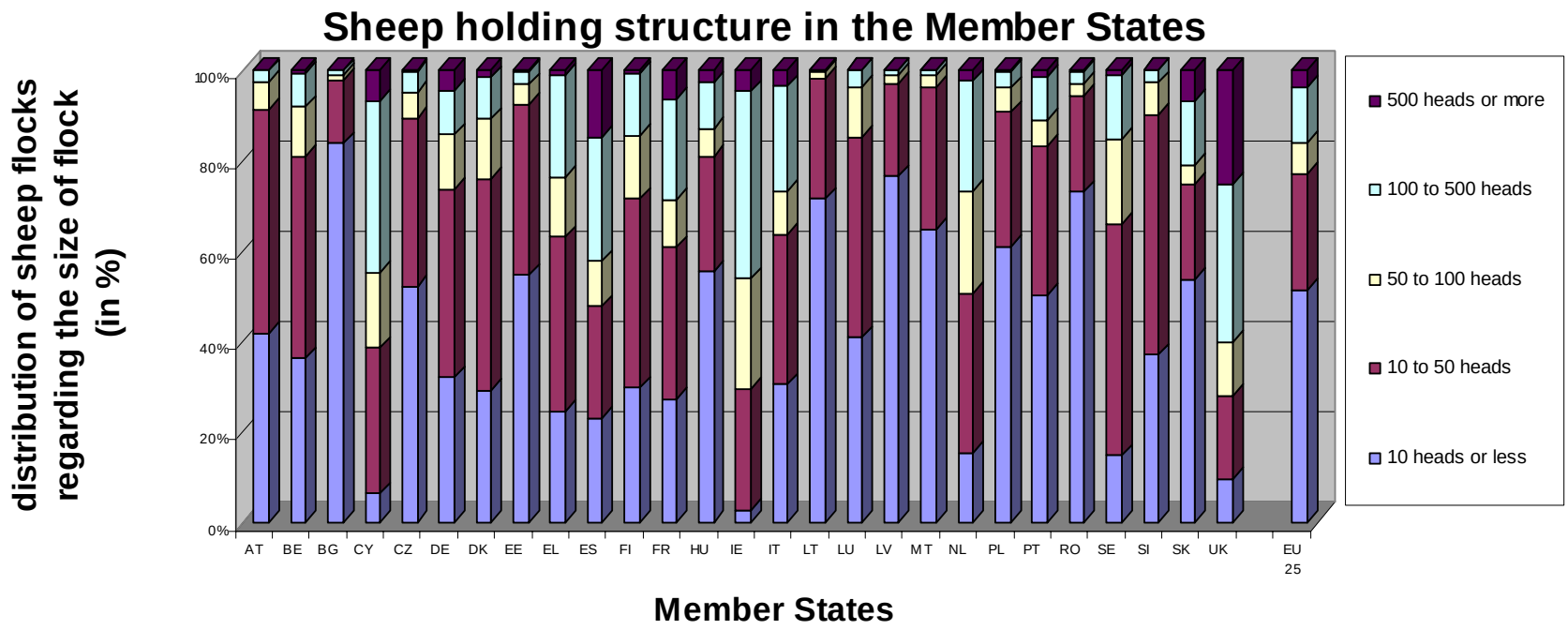

Table AII-2: Distribution of sheep holdings in the national flock regarding their size (figures from Table AIII-1a)

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.