SIXTH FRAMEWORK PROGRAMME
SSP 8.1
POLICY-ORIENTED RESEARCH (SSP)

Contract for:

SPECIFIC TARGETED RESEARCH PROJECT

Annex 1 - "Description of Work"

Project acronym:	LAYWEL
Project full title:	Welfare implications of changes in production systems for laying hens
Proposal/Contract no.:	502315

Date of preparation of Annex 1: 24-Nov-03

Operative commencement date of contract: 1 January 2004

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1. Proposal summary

Welfare implications of changes in production systems for laying hens

Acronym: **LAYWEL**

Task and strategic objectives addressed:

This proposal addresses the strategic objectives of:

Area: 8.1.B.1.4: New and more welfare friendly production methods to improve animal health and welfare including research on animal diseases such as foot and mouth disease, swine fever and development of marker vaccines.
- Research to support the formulation and upgrading of specific policies on animal welfare

Task 7: Welfare implications of changes in production systems for laying hens: to optimise rearing systems in particular enriched cage systems, for laying hens

Proposal abstract

The conditions under which laying hens are kept remain a major animal welfare concern. It is one of the most intensive forms of animal production and the number of animals involved is very high. Directive 1999/74/EC setting-down minimum standards for the protection of laying hens allows three different categories of farming systems: unenriched cages, alternative systems and enriched cage. The provisions of the Directive are being progressively implemented since 2002 and have introduced technical changes in the current systems. Since there is only restricted practical experience with production in enriched cages, and since modifications to the current systems have been adopted, knowledge on the welfare implications of the different poultry farming systems needs to be updated.

The LayWel project will produce a series of reports on the various welfare aspects of laying hens. Although special emphasis will be put on enriched cages and the welfare of laying hens housed in it, alternative housing systems, such as aviaries and free range systems will also be investigated. The final report of the layWel project will give a method to estimate the welfare of laying hens in any kind of housing system.

As the LayWel project will focus on the welfare of laying hens, all workpackages (WP) will be seen in this perspective and will therefore only deal with aspects influencing bird welfare.

The WPs leading to the final report are:
1. Welfare definitions
2. Housing systems
3. Health
4. Behaviour
5. Physiology and stress indicators
6. Productivity and egg quality
7. Integrated welfare assessment

2. Project objectives

3. General objective

Welfare of laying hens is still a matter of discussion. The EU-Directive 1999/74/EC sets the outlines for the various systems that will be allowed for housing laying hens. At the time this Directive was adopted, most information on enriched cages came from studies in labs or small scale units. Also, since then, a lot of new information is available on alternative housing systems, such as aviaries and free range systems. The LayWel project will put special emphasis on enriched cages and will provide extensive and adequate information about the various welfare aspects in this system using new data from research conducted in the LayWel project.

The general objective of the LayWel project is to produce a series of reports on the welfare of laying hens in various systems, with special focus on enriched cages, and to make the information well known, particularly over all member states of the EU and associated countries. The first drafts of the deliverables from WP1 - 6 will not only be reviewed by partners of the Laywel project, but also by experts from other EU- and associated countries. Thereafter the results will be presented and discussed during a workshop at the 7th European Poultry Welfare Symposium that will be held in 2005 in Poland. Participants will be invited to comment and provide additional information. It is expected that many scientists specialised in welfare issues will attend this meeting. Also substantial delegations from eastern European countries are expected, who will not only attend the workshop, but will also present their research results at the Symposium. Both the symposium and the workshop will generate valuable additional information, that will be used to review and finalise the reports1 - 6 and to generate report 7.
This 7th and final report of the layWel project will give a method to estimate the welfare of laying hens in any kind of housing system.

4. Objectives per Workpackage

WP1: Laying hen welfare: definition and indicators

To produce the reports on the various welfare aspects of laying hens, as a start a consensus needs to be obtained regarding the relevant definition of welfare. The objective of WP1 is to produce a consensus definition of laying hens' welfare, including indicators of welfare, to work from in the rest of the project. The output of this WP will be a report with a definition of laying hen welfare with argumentation for choices made and a description of the steps taken to formulate the definition and to obtain consensus. WP1 will deliver the first draft after 6 months and will finish the work in the first year of the LayWel project.

WP2: Housing systems

WP2 is needed to harmonise terminology throughout the other WPs and to be able to evaluate welfare on the basis of system criteria and provisions. As WP7 will combine information from all other WPs, the description and working systematics in each WP should be compatible. The objective of WP2 is to identify in detail the different categories of housing systems for laying hens, to describe the range of variation within these categories and their significance for European egg production. It will emphasise the enriched cage systems.
The output of WP2 will be a report with descriptions of the different categories of housing systems for laying hens, a description of the variation and the various systems within categories and regional distribution of these systems. As these descriptions will be necessary for the other WPs the work will commence at the start of the project and will have the first draft ready in the first year of the LayWel project. In the second year of the project there will be a check for changes and new developments, after which the chapter will be updated and finalised.

WP3: Health

The overall objective of WP3 is to generate, process and compile relevant data on the health of laying hens in enriched cages and alternative housing systems. This will be done according to the housing categories described in WP2. WP3 will put special emphasis on:

- Co-ordination and documentation of a scoring system for bird health and welfare, including the condition of the integument, to make it possible to compare trials done in different countries.
- Providing data from enriched cages and alternative housing systems on:
    - integument of birds, e.g. plumage condition and pecking damage on skin.
    - skeletal damage and bone strength, e.g. twisted keel bones or fractures.
    - autopsy and disease outbreaks
    - mortality and production
    - air condition in poultry houses as related to welfare

The output of WP3 will be a report with an overview of the health status of laying hens in enriched cages and alternative housing systems, recommendations to improve health and a general applicable scoring system for bird health and integument. The report will contain a thorough review of the literature, and will also present new research results generated in this WP.

WP4: Behaviour

The overall objective of WP4 is to generate data concerning the needs, preferences, distribution, behaviour and use of facilities and enrichment components by birds housed in various experimental and commercial enriched cages and other egg production systems across Europe. The system categories as described in WP2 will be used. Various hybrids kept at different group sizes and stocking densities will be the subjects of the investigations. WP4 will put special emphasis on:

- Bird preferences in relation to enrichment components: The objective is to provide an overview of the main literature findings, and caveats concerning interpretation of the literature on bird preference, motivational strength and 'demand', and of direct relevance to the experimental work.
- Prevalence of feather pecking in enriched cages and other production systems.
- Substrate needs and preferences.
- Behavioural indicators for evaluating substrate quality.
- Evaluation of litter quality in enriched cages and other production systems.

WP4 will lead to a report with definitions of enrichment components and an overview of bird needs and preferences for these components. As regarding components most of the discussion is about litter, special emphasis is put on this aspect. Also regarding behaviour in enriched cages and other production systems feather pecking is a major issue and will therefore be discussed in detail. In the first year, prior to the research component on litter preference, a review of relevant literature will be made. In the second year the review and the new research findings will be combined and the report will be finalised.

WP5: Physiology and stress indicators

The objective of WP5 is to find and formulate physiological parameters that give objective information on the actual stress levels of laying hens and therefore will be a help in assessing the welfare situation of laying hens in enriched cages and alternative housing systems.
WP5 puts emphasis on:

- Physiological parameters for the assessment of acute and chronic stress of laying hens (corticosterone concentrations in blood and faeces, heterophyl/lymphocyte (H/L) ratio, humoral responses)
- Physiological stress responses in enriched cages and alternative housing systems, taking into account differences in hybrids, climate and management across Europe.

The output of WP5 will be a report presenting the review of the literature and new research results on physiological stress parameters and physiological stress responses in enriched cages and alternative housing systems. The review will be made in the first year of the LayWel project. In the second year new research findings will be added.

WP6: Productivity and egg quality

The objective of WP6 is to describe the productivity and egg quality traits of laying hens in different production systems in relation to welfare. Observations from unenriched cages, enriched cages, barn systems, and aviaries using laying hens of a number of breeds and at a range of stocking densities, over full laying cycles and up to commercial flock scale will be used. WP6 will consider how the data contribute to our knowledge of welfare, and the suitability of various productivity variates as welfare indicators will be discussed. Information and data from partners in UK, Sweden, France, Germany, Netherlands and Spain will contribute to WP6. Available information from accession countries, and where relevant from elsewhere, will be comprehensively incorporated.
WP6 will put special emphasis on:

- Measuring, and relating to welfare, egg production, egg weight, egg output, bird body weight, egg quality, second quality eggs, feed intake and mortality in unenriched cage systems, enriched cages, barn systems and free range systems.
- The connection between production data and the welfare indicators identified in WP1.

The output of WP6 will be a report presenting an overview of productivity and egg quality traits relevant for bird welfare, their connection with welfare indicators and the differences in these traits related to housing system. After the first year an interim report will be presented, containing a review of available information and data. In the second year new research findings from the project will be added, the information will be fine-tuned with WP1 and 2 and the report will be finalised.

WP7: Integrated welfare assessment

The objective of WP7 is to integrate the information obtained from all preceding WPs to make an overall assessment of the impact of enriched cages and alternative housing systems on the welfare of the laying hen. The information of the preceding WPs will be presented and discussed during a Workshop at the 7th European Poultry Welfare Symposium in 2005 in Poland. As participants of this Symposium will be invited to comment and provide additional information, the input in WP7 will add breadth to that coming from the preceding WPs and will have a clear input from eastern European countries.

The integration of information will proceed by a number of stages. First, an overview of the quantitative data available from a wide range of replicated studies and commercial-scale trials in the EU and associated countries will determine whether health, physiological, behavioural and production indicators of welfare co-vary. The findings from WP 3, 4, 5 and 6 will be evaluated and areas of consistency and inconsistency in results relating to bird welfare will be identified. It will then be considered how to apply weighting factors to reflect the relative importance of each measure. An assessment will be made to determine whether the risk of rare but catastrophic events, such as fire, power failure, or disease that would impact severely on bird welfare, varies across housing system. Lastly, an assessment will be made of how climatic and regional factors might impact on the welfare of birds housed in different systems. This will result in a model that can be used to evaluate the welfare of hens in any housing system.
A final important objective of this WP will be to develop a manual that can be used to evaluate the welfare of laying hens at a farm level in whatever housing system they are held.

5. Contractor list

List of Participants

Partic. Role*	Partic. no.	Participant name	Participant short name	Country	Date enter project**	Date exit project**
CO	1	Institute for Animal Science and Health ID-Lelystad	ID-Lelystad	NL	1	24
CR	2	Research Institute for Animal Husbandry PV-Lelystad	PV-Lelystad	NL	1	24
CR	3	ADAS Consulting Ltd. - Gleadthorpe Poultry Research Centre	ADAS	UK	1	24
CR	4	Danish Institute of Agricultural Science	DIAS	DK	1	24
CR	5	Institut National de la Recherche Agronomique – Poultry Research Unit	INRA	F	1	24
CR	6	Swedish University of Agricultural Science	SLU	S	1	24
CR	7	University of Bristol	UNIVBRIS	UK	1	24
CR	8	Univerität Hohenheim	UHOH	D	1	24
CR	9	Universidad de Zaragoza	UNIZAR	E	1	24

*CO = Coordinator
CR = Contractor

** Normally insert “month 1 (start of project)” and “month n (end of project)”
These columns are need for possible later contract revisions caused by joining/leaving participants

6. Relevance to the objectives of the SSP Priority / activity objectives

7. Problem description

Poultry industry

The total egg laying flock in Europe comprises approximately 250 million birds. The birds are reared either in cages or on the floor until their transfer to laying houses at point of lay (16-18 weeks). Although a growing proportion is then kept in alternative systems, the predominating system for the production of eggs in the EU is still the battery cage (unenriched cage). In this system the birds are housed in small groups (3-5) for the rest of their lives, generally until 74 weeks of age. The degree of confinement in battery cages and their barren, invariant nature has elicited significant public concern over the past 30 years. Indeed, housing hens in battery cages has been associated with increased fear, stereotyped behaviour and bone weakness and with reduced behavioural repertoire (Mills and Wood-Gush, 1985; Knowles and Broom, 1990; Appleby and Hughes, 1991; Jones, 1996).

Legislation

Widespread public debate has stimulated the call for more animal-friendly, alternative systems. Council Directive 88/166/EEC (EU, 1988) has formulated minimum space allowances as well as other aspects of housing laying hens, but this was only seen as minor improvements of bird welfare as birds were still restrained from several of their basic needs. In 1996 the Scientific Veterinary Committee published a report on the welfare of Laying hens (EU-SVC, 1996), which formed the basis for the current debate on housing of laying hens.
In 1999 Directive 1999/74/EC setting-down minimum standards for the protection of laying hens has been put into force. This Directive restricts the housing of laying hens to three different categories of farming systems: unenriched cage, alternative systems and enriched cage.
The so-called "unenriched cage" (battery cage) will be phased-out by 2012. Free-range and barn systems are used as "alternatives". The use of cages improved by environmental enrichments (so-called enriched-cage systems) is currently marginal. For the marketing of “free-range eggs” Commission Regulation No 1651/2001 (EU, 2001b), amending Commission Regulation (EC)1274/91 (EU, 1991) introducing detailed rules for implementing Council Regulation (EEC) No 1907/90 on certain marketing standards for eggs, sets out additional conditions regarding the housing system in which these eggs are allowed to be produced.
The provisions of the 1999 Directive are being progressively implemented since 2002 and technical changes in the current systems (unenriched and alternative) have been introduced. Since there is only restricted practical experience with production in enriched cages, and since modifications to the current systems have been adopted, knowledge on the welfare implications of the different poultry farming systems needs to be updated.
Not all member states of the EU have implemented the 1999 EU-Directive in the same way. Some countries have set more strict regulations. In particular, the speed in which unenriched systems will be phased out (e.g. Sweden, Germany), a ban on beak treatments (e.g. Sweden, Finland) or the ban of certain systems (e.g. enriched cage in Germany).
In the 1999 EU-Directive the term "enriched cages" is used and in the literature the term "furnished cages" is also used. Both terms refer to the same type of system. In this project the term "enriched cages" will be used, as this is also the term used in the Directive.

8. General relevance of the project

The conditions under which laying hens are kept remain a major animal welfare concern. It is one of the most intensive forms of animal production and the number of animals involved is very high. Directive 1999/74/EC setting-down minimum standards for the protection of laying hens was adopted in an attempt to give these birds more possibilities to perform their species specific behaviour and thus improve their welfare. The Directive allows three different categories of farming systems: unenriched cages, alternative systems and enriched cage. At the time the Directive came into force, enriched cages were still under development. This system aims to give hens more freedom of movement and elements to ensure good

welfare for the hens. However, as the system was only just developed, the knowledge of its functioning under commercial conditions is not well documented. Many cage manufacturers have developed new models of enriched cage systems and, although they all are within the lines drawn by the Directive, there is a need for compiling new data on a wider basis, e.g. commercial farms, in order to evaluate the actual welfare status of hens in these systems.
Although Directive 1999/74/EC describes only three different categories of farming systems, the variety within each category is of such an extent that determining the welfare of hens is too complex to fit into these categories alone. Welfare assessment should be seen independent of any categories. However, to accomplish a model for this assessment, some kind of categorisation is necessary for data collection and assessment of the model.
Directive1999/74/EC has introduced technical changes in the current systems. Not only traditional battery cages are being modified, but also new alternative systems (aviaries) have been developed. The modifications are driven by legal requirements and marketing strategies. This was foreseen in the 1999 Directive. Article 10 of Directive 1999/74/EC requires the Commission to present a report on the various systems for keeping laying hens, in particular those covered by this Directive which shall take into account pathological, zootechnical, physiological and ethological aspects, and their impact on health and the environment.

The fact that so many countries are represented as partners in the project, will be an important means of further developing poultry husbandry in a welfare friendly system in the EU. The many relevant contacts each partner has will ensure intensive communication and consultation of other EU and associated countries. A wider societal aspect of the project is that its objectives strive towards fulfilling a demand from society that animal welfare friendly environments should be used in the animal production sector.

9. State of the art and relevance of the different WPs

WP1: Laying hen welfare: definition and indicators

An animal's welfare is sensitive to many different kinds of factors acting on various time scales, for which there is no simple, objectively measurable common currency. Moreover, scientific knowledge about animals' subjective states – which are key elements in animal welfare – is very imperfect (maybe even inevitably so). Nonetheless, many scientists across the world are studying animal welfare from many different perspectives.
The understanding of welfare in farm animals in general, and in laying hens in particular, is subject to modifications through progress in biological research and by trends in concern of the societies on the prevailing conditions of animal husbandry. The perception of welfare in laying hens varies among the countries of the EU, associated countries and social groups within countries. Some attempts have been made to come to a consensus around issues of the definition of animal welfare (Anonymous, 2001).
As stated, with progressing scientific knowledge of the functioning of animals and their perception of their environment, the definition of welfare is likely to change. However, for a contemporary review of the welfare of laying hens in various housing systems it is important to have a currently accepted definition of welfare. This will enable a focussing of the discussions on matters of concern. With input in this WP of countries from different regions of Europe, a general acceptance of the approach is to be expected, making it very relevant for the European discussion on poultry welfare.

WP2: Housing systems and legislation

For cage systems there is a stepwise phasing out of unenriched cages, finally leading to only enriched cages and alternatives (with or without free range) being allowed.
Not all housing systems within a category have the same impact on bird welfare. Enriched cages, especially, vary widely in lay-out and thus, potentially, in impact on welfare of the birds. Aspects that are well controlled in some systems may be more critical in other systems and for instance space, litter area and group size may differ considerably. To be able to estimate and compare the welfare of laying hens in the various systems for keeping laying hens it is, therefore, important to identify these systems in more detail than the legal categories. This needs to be done in a clear way leaving no discussion about the names of systems or categories of systems used throughout the whole project. Furthermore it is relevant to consider the national differences in legislation that may influence research results in more than just details, to be able

to understand local differences in use and results with the various housing systems. Before comparing research results one should have some ideas of the background of these researches.

WP3: Health

Health traits, including mortality, are very relevant for the assessment of welfare of laying hens in different housing systems. The presence or absence of certain elements in housing systems can affect the health condition of the hens. For example, the presence of litter means a higher risk for certain diseases. In these situations the litter is an essential element in the life cycle of the parasite or microbe and hens come into contact with these disease risk through the litter. On the other hand the risk for feather pecking and cannibalism may be reduced if birds have access to litter (Blokhuis, 1986). One of the basic needs of laying hens is to perch and providing perches, especially combined with extra space, increases bone strength (tibia and humerus; Nørgaard-Nielsen, 1990; Tauson & Abrahamsson, 1994, 1996; Van Niekerk & Reuvekamp, 1994). However, a suboptimal design of perches can result in keel bone deformations (Tauson & Abrahamsson, 1996). Differences in design of the housing system can result in differences in incidence of foot pad lesions, wounds and soiling of the system and birds with manure (Abrahamsson & Tauson, 1995). Since the implementation of EU-Directive 1999/74/EC a lot of research has been conducted on different enriched cages and alternative housing systems, and the health status of the hens has often been a part of these studies. Apart from mortality and disease problems, most of these studies scored the integument of the hens (skin, feathers), as it can give important information about the health of the hens with regards to possible damage caused by the system or by feather pecking. However, several different scoring systems are used to evaluate the integument (Tauson, 1984; Gunnarsson, 2000) This implies that although a relative comparison between systems in the same experiment can be carried out, the evaluation of one single system between experiments is more difficult. Hence, the co-ordination of scoring procedures will facilitate not only the evaluation in field conditions, but also for comparison with the literature.
National Directives for minimum welfare standards differ in several details, not only between EU- and associated countries, but also within current EU member states, and thus have their influence on the health of the birds. For instance, while beak trimming is prohibited in Finland and Sweden it is allowed in the rest of EU if performed before 10 days of age. In non beak trimmed birds the risk for cannibalism is higher, resulting in a higher health risk (Abrahamsson & Tauson, 1995, Fiks-van Niekerk et al., 2001).
Finally the climatic situation in different EU-countries varies and influences bird health in different ways. For example coccidiosis is more a problem in systems with relatively wet litter. Climate will have an influence on litter moisture content. Strict rules for environmental care in the Netherlands means that housing systems have manure drying systems and low ammonia emission from the henhouses (Groot Koerkamp et al., 1996). In other countries the solution may be sought in other systems or the need for reduction of emission may not be so high. With differences in ammonia and dust levels in the henhouses, differences in health status of the hens can be expected. WP3 will produce a review of the available information taking into account the system categories, described in WP2, and the climate differences between EU-countries and information from associated countries will be incorporated.

WP3 will report recent information on health traits from a range of countries. This applies especially to enriched cages of various designs and group sizes in commercial farms as well as under experimental conditions. Also the health status in other alternative systems (Tauson, 2001) as well as in unenriched cages will be reported on in WP3. Important data on floor systems with free range in commercial use will also be available (van Emous & Fiks-van Niekerk, 2003) as well as genotype-environment interactions on plumage condition in selected lines (Kjaer & Sørensen, 2002).

The information gathered in WP3 will not only describe the health situation in the different housing systems but also provide data in order to improve and optimise the systems. Several of the alternative systems studied, and especially the enriched cages, should be considered a new system as far as commercial use is concerned. It is obvious that many different types of enriched cages show different results as regards health, behaviour and production. Hence, the potential for improving results is considerable (Wall & Tauson, 2002) and it is of vital importance that new data are compiled in order to enhance the development of this system as one of the alternatives to unenriched cages. Today the commercial use is mostly in Sweden where already about 25% of layers are kept in enriched cages. However, there are comprehensive data on health traits on farms with this system from Sweden (Tauson et. al., 2002; Tauson & Holm, 2002, 2003), Great Britain (Appleby et al., 2002) and Germany (Rauch et al., 2002). Data mainly from laboratory studies are available

from The Netherlands, Spain and France. The different partners not only represent different situations in terms of location in Europe and climate but also the use of genotypes (light white or brown medium heavy birds), beak trimming and different group sizes. This fact makes it even more urgent to report on possible interactions with the keeping system *per se*. It is expected that this will apply to most systems - including the enriched cages.

WP4: Behaviour

The behaviour of the laying hen is highly relevant to animal welfare. Fundamental studies can identify the behavioural needs and motivational priorities of laying hens. Enriched cages and alternative housing systems can then be examined to ascertain whether they permit these behaviours to be performed. In addition, the appearance of damaging pecking (including mild and severe feather pecking, and vent pecking) can directly reduce the welfare of recipient birds.
In Council Directive 1999/74/EC it is stated that in enriched cage systems for laying hens litter should be provided in such a way that pecking and scratching are possible. Besides pecking and scratching litter has a function in the performance of dustbathing behaviour in laying hens. When the supplied litter is inappropriate, vacuum dustbathing or disturbed dustbathing behaviour is observed (Larsen and Hogan, 2000; Van Liere, 1991; Widowski and Duncan, 2000). This indicates that dustbathing is important for the hen and those hens may suffer if they are unable to perform this behaviour. Moreover, litter has an important role in preventing the development of abnormal behaviour like feather pecking and cannibalism (Blokhuis, 1989; Blokhuis and Van Der Haar, 1989).
Observations in enriched cage systems show that dustbathing behaviour is often disturbed and that abnormal behaviours like feather pecking and cannibalism are still present (Olsson et al., 2002; Van Rooijen, 1998, 2001). This may indicate that the litter as provided in these systems does not fulfil the behavioural needs of the hens. In alternative housing systems like aviaries or free-range systems, feather pecking can be a major problem as well, especially when non-beak trimmed hens are used (Savory, 1995). This suggests that also here the environment is not completely adequate to the hens, which may have negative implications for their welfare.
Although we have some knowledge of the various types of substrates that are preferred to perform specific behaviours such as dustbathing or pecking and scratching, it is unknown how the different characteristics of litter contribute to the performance of normal behaviour. Knowledge of the preferences of hens for different types and characteristics of substrate may help to improve enriched cage systems and alternative housing systems with respect to bird welfare.
In commercial poultry husbandry laying hens of many different genetic backgrounds are used. It is important to know if the preference of for example litter is equal for the different hybrids. Hybrids that differ in their feather pecking behaviour could very well differ in their preference to certain litter substrates. This would mean that the type of litter in a certain housing system should be chosen based on the hybrid used. The feather pecking lines, which are being developed in Denmark, are unique for investigating these correlations and will be used in this WP.
Litter is one of the enrichment components of housing systems for laying hens. Other components are indicated in the EU-Directive as well, such as nests, perches, claw shorteners, space. WP4 will identify these components and will formulate their appearance and their behavioural function for the hen.

WP4 will contribute knowledge to the assessment of behavioural function of various systems or system components. Both advantages and disadvantages of changes in production systems will be identified. Recommendations will be made for improvements to the design and specification of production systems where necessary, in particular where those systems are new, such as enriched cages for laying hens. The 1999 EU-Directive emphases the presence of litter in various housing systems, however, as information on this subject was not available at that time a clear description of the quality of the litter, regarding the needs and preferences of the birds, could not be incorporated. WP4 therefore puts special emphasis on this item aiming on providing the necessary information on litter preference and quality.

WP5: Physiology and stress indicators

There is a general agreement that systems or practices that lead to injury, disease, or any reduction in physical health are detrimental to welfare. Poor welfare may also result from confinement, restriction or poor environment. It is recognised that there is no single magic indicator of welfare and that several should

be used in conjunction. Physiological variables are strong indicators of stress responses of animals but should be evaluated against a thorough analysis of the behaviour expressed and the emotional state. Indeed, the way in which birds respond will depend on where the threat to their welfare comes from. Responses common to different sorts of threat do exist but they should be demonstrated and not be assumed *per se*.

Sapolsky (1992) indicated that damaging consequences of stress on health and well being may occur when prolonged intense physiological responses are involved. However, regardless of duration, continuous imposition of low intensity stressors may induce habituation without development of a pathological state. In general stressors impede production of antibodies and effective cell-mediated immunity. Otherwise, owing to a change in leukocyte population in relation with stress and especially with changes in plasma corticosterone levels, an increase in the heterophil-lymphocyte ratio (H/L) is considered as a good stress indicator in birds (Gross & Siegel, 1983; Siegel, 1987; Jones et al., 1988; Mitchell et al., 1992; Maxwell, 1993).
When discussing stress, the nervous and endocrine systems are a primary focus (Siegel, 1971). Once a stressor has been perceived, two distinct pathways involving physiological reactions are evoked, the sympathetic adrenomedullary (SA) system, which lead to a very short term response, and hypothalamic-pituitary-adrenal (HPA) axis. Activation of the sympathetic adrenomedullary system can be assessed directly (catecholamine measurements) or indirectly (heart rate frequencies) but is not easy to perform on a large scale basis in commercial flocks. Increases in corticosteroids, mainly corticosterone in birds, are most often associated with situations that humans find undesirable. However, increased concentrations in corticosteroids are also associated with experiences that are pleasurable such as sex and the anticipation of food (Toates, 1995). Changes in its concentration are thus rather a preparation for an action that may be either aversive or pleasurable, that is to say associated with poor welfare and welfare enhancement in the opposite context. In brief, corticosteroids are part of the means that animals have to mobilise stores of glucose in order for actions.
Concerning the possible detrimental effects of stress, it is also essential that boundaries are drawn between acute and chronic stages of the stress response. Handling an untrained hen for a brief period will be perceived as an acute stress associated with a rise in corticosterone while prolonged confinement in over-crowed conditions might be perceived as a chronic stressor (Mitchell et al., 1992; Kettlewell and Mitchell, 1994). Activation of the adreno-corticotrope axis of birds in response to an acute stress has been demonstrated (Dantzer and Mormede, 1979; Munck et al., 1984; Mitchell et al., 1992) and is reflected by an increased concentration of corticosterone in the plasma of the peripheral circulation (Beuving and Vonder, 1978; Harvey et al., 1980). On the other hand, chronic stress induces long-term changes in the regulation of the adreno-corticotrope axis (Janssens et al., 1994) in relation with the steroid feedback. Indeed, chronic stress or repeated acute stresses such as repeated handling can result in a progressive decrease in corticosterone response (Dantzer and Mormede, 1979; Jones and Faure 1981; Rees et al., 1983; Grandin, 1988). An approach to investigate chronic stress consist in using ACTH challenge (Thorn et al., 1953) to measure the adreno-corticotrope axis sensitivity and maximal reactivity (Landsberg and Weiss, 1976; Koelkebeck et al., 1986; Mormede, 1988; Janssens et al., 1994; Guémené et al., 1999, 2001).
With regards to responses of different hybrids it is known that these may be different (Korte et al., 1997, Beuving et al., 1989). At present, although there are some trials going on, the available experimental data related to physiological stress responses in enriched cages and alternative housing systems are very scarce.

Although not all physiological stress responses are detrimental to the bird, a fairly high correlation is found between the parameters mentioned and suboptimal conditions for the bird. These parameters therefore can be used as valuable information on how an animal perceives its environment and so how suitable this environment is to the animal. WP5 focuses on the mentioned physiological parameters to evaluate welfare, especially parameters expressing stress.

WP6: Productivity and egg quality

A problem when using production as a welfare parameter is that it can be interpreted in different ways, such as mass output of an individual or flock or efficiency in terms of inputs, economics or labour etc. (Duncan and Dawkins, 1983), while a good level of production does not necessarily indicate a good level of welfare. However, a sudden drop in production or production parameters may indicate a welfare problem (Blokhuis and de Wit, 1992). The relationship between production and welfare is complex. For example, provision of perches improves bone strength (Hughes and Appleby, 1989) but there can be detrimental consequences on

production in terms of increased cracked or dirty eggs (Barnett and Hemsworth, 2001). Stress in laying hens is known to affect egg quality, for example, causing over calcification of egg shells (Hughes et al., 1986; Mills et al., 1987, 1991).

WP6 focuses on production and egg quality, from the perspective of bird welfare. Although hens are selected for high production and they will maintain their production even under suboptimal conditions, a more detailed investigation makes it possible to get information about the welfare status of the hens. Most obvious is the situation where disease problems affect production levels. In addition, it is known that certain abnormalities of the egg-shell are related to stress or absence of essential elements in the environment of the hen. Information on the production and egg quality is, therefore, necessary to form a complete idea of the welfare of laying hens.

WP7: Integrated welfare assessment

Animal welfare is a combination of subjective and objective (qualitative and quantitative) aspects of the conditions of life for animals, and is thus a complex and – to some extent – an abstract concept. The measure of animal welfare is fraught with difficulties as it is impossible to measure directly the animals' subjective experience of pain, discomfort or behavioural restriction. Despite this, considerable progress has been made in recent years in developing health, physiological, behavioural and production indices that relate to welfare, and in determining the extent to which experts in the field agree on welfare issues (Anonymous, 2001) and agree on how to measure welfare (Broom, 1991; Nicol, 1997; Fraser et al., 1997). This research has been applied to assess the welfare of laying hens in new systems at a national level (e.g. a UK evaluation of enriched cages Appleby et al., 2002). It is now timely that research in this area should transcend national boundaries to produce an integrated European perspective agreed on by associated countries as well as by current member states. There is currently great interest in methods of combining different welfare indicators into meaningful scales, and this was the theme of an international workshop on Assessment of Welfare at the Farm and Group level, held at Bristol in 2002 (proceedings in press). We will take account of this knowledge and the information in our interpretation of the welfare of laying hens in the enlarged EU.

Animal welfare is a difficult concept, and a state that may be impossible to measure directly. For this reason it is essential to reach agreement about the relevance of different welfare parameters to overall welfare state, but also to acknowledge the role of factors that cannot be measured conventionally. The overall assessment of the impact of housing system on laying hen welfare requires a broad and open-minded consideration of both quantitative and qualitative factors. WP7 will integrate the information to the assessment of laying hen welfare in a manner that is relevant to both the requirements of Directive 99/74EC and the wider goals of the EU. The final report will highlight the strengths and weaknesses of enriched cages and alternative housing systems taking groups of related measures to be independent indicators of welfare, and will also describe the overall welfare impact of each housing system. There has not been a previous attempt to co-ordinate such a broad range of quantitative and qualitative information for this species. The value of this study will be that experts from different member states and associated countries combine forces to provide an overall view of how laying hen welfare is affected by housing system.

10.Potential impact

11.Contributions to standards

The LayWel project focuses on welfare and housing of laying hens. The unique character of this project is the co-operation between so many highly qualified research units in different regions of Europe combined with the fact that all the research work will be evaluated on the basis of a shared understanding of principles. This will allow combination of results from the different regions, making it possible to draw general conclusions.

European legislation on the welfare and housing of laying hens is being set by Directive 1999/74/EC. Member states have to comply with the limits drawn in this directive. However, more strict regulations are allowed and several member states have decided on enforcing stricter rules.

With regards to associated countries the contribution to their national standard will depend on many aspects, joining the EU being one of them. By close contact and communicating with scientists in these countries throughout the course of the project mutual understanding will be sought. On one hand the growing knowledge and understanding of the European ideas and standards on animal welfare issues may lead to follow-up in associated countries. On the other hand increased understanding of the situation and the ideas in the associated countries will give the EU more insight in how to realise a widely supported standard for animal welfare and more uniformity between the enlarged EU.

12. Contribution to policy development

General impact of the project

EU-Directive 1999/74/EC sets down minimum standards for the protection of laying hens. EU-Directive 1907/90 (with amendment 5/2001) and 1274/91 (with amendment 1651/2001) set down standards for trade. EU-Directive 1999/74/EC distinguishes 3 categories: unenriched cages, enriched cages and alternative systems. EU-Directive 1274/91 described 5 categories for trading eggs. In the amendment this has been brought back to 3 categories: cage eggs, barn eggs and free range eggs. This amendment was made as a logical step in the implementation of EU-Directive 1999/74/EC.

Egg production is an important rural food production branch in most European countries. In several associated candidate countries the poultry industry is growing rapidly. Evaluation of the 1999 Directive therefore will be of interest to a wide range of countries. Climate and cultural differences of the various European and associated countries affect local poultry keeping, its importance and position in society and the perception by the consumers of this type of animal husbandry. The consortium partners are known worldwide and respected for their expertise and their outstanding scientific work and therefore will guarantee a high scientific standard of the report they will produce. Connections with major scientists in associated countries will also be strengthened.

Finally, the composition of partners from many countries involved in the welfare topic of poultry will promote a good network for contacts with other national and international research activities. Examples of such are already finished projects, ongoing and planned ones on other traits within the poultry sector, e.g. egg quality, economics or environment both in Europe and in other continents - like the U.S. or Australia.

Impact of the different WPs

The main trust of WP1 is to define a common definition to work from in this project. WP1 will have an impact on the vision on animal welfare, as the input of scientists coming from very different regions in Europe is foreseen. It is likely to be accepted as a general view on welfare, taking into account the state of art of the moment, and thus will be of great help in evaluating the welfare of laying hens in various housing systems.

WP2 deals with the different categories of production systems. As a start it takes into account the lines set by the 1999 Directive. New developments in systems, especially in enriched cages, and the wide variety within the categories, will make a closer look necessary. The choice for the categories and the description of the systems will be made with the aid of many research groups that are leading the field in different countries. The description of the categories will not have a direct impact on matters outside the project. However, it will be of great importance for a smooth connection of all WPs, and therefore will have an impact of the final report, being the output of WP7.

The strategic impact of WP3 relates to its assessment of welfare as regards a wide range of health parameters including mortality. Since physical health, as described earlier, is one of the most obvious welfare traits it is of the greatest importance that these are reported on, in order to fully describe welfare mainly in alternative systems but also in relation to the currently used conventional ones. Hence, the data provided will be complementary to other welfare related traits reported on in WP4-6 on topics related to behaviour, physiology and production.

Further more, WP3 will produce comprehensive data on the advice needed to farmers on how to manage new systems in order to promote the welfare of the birds but also reach an efficient and economic production.
A considerable part of the activities in WP3 will be of an innovative character. This relates both to the fact that methods are reviewed and co-ordinated as well as the presentation of possible improvements for new designs of important details or management factors in the systems. Many of the incorporated projects are complementary to each other in terms of methodology and/or systems studied.

The strategic impact of WP4 relates to its contribution to a better understanding of behavioural needs of laying hens and thereby enhancing design of production systems for laying hens with respect to welfare.
Design innovation is integral to the development of new egg production systems, in particular enriched cage systems. However such innovations must not be introduced at the expense of the birds' welfare. WP4 will assess the effect of innovations such as the incorporation of foraging facilities in cages, on behavioural preferences and how birds use and perceive these facilities. This might very well give rise to suggestions for changes on various parameters such as technical design, maximum stocking density, litter provision and quality, group size and so on.

WP5 deals with physiology and stress. Physiological stress parameters can be a valuable measure of the animal welfare status and as such complement the information obtained from behavioural, health and production parameters. WP5 will give a presentation of the most recent results in this field and will also give validations for a number of measures. It will result in a widespread acceptance of the viability of these measures and will provide important information for the welfare discussion.

WP6 deals with production and egg quality. High production is often misused as an indicator of good welfare. As laying hens are bred for high production suboptimal conditions will not easily effect their production level. On the other hand production can give indications for impaired welfare. WP6 will give a clear view and scientific proof as to what aspects of production and egg quality are related to bird welfare.

The strategic impact of WP7 relates to its contribution to an overall definition of welfare, identification of welfare indicators, and the assessment of the extent to which indicators co-vary. It will emphasise the effect of enriched cage systems, integrating in particular data from workpackages 3, 4 & 5 while putting these data into context with production data from WP6. It will be used as support for a welfare scoring system for laying hens.
WP7 will incorporate data and information from international partners whose own projects are complementary in terms of objectives and methodology. Each partner also has domestically-funded research projects relating to welfare and productivity of laying hens in different production systems. Each partner will contribute the interpretation of data obtained in the preceding work packages and will contribute their expertise to the development of an agreed welfare scale. By incorporating the information and opinions of associated countries the impact of WP7 may well go beyond European boundaries.

13.Risk assessment and related communication strategy

The LayWel project as such does not bear any potential risk for society or citizens. Improving health status of laying hens may even reduce potential risk for citizens, as the zoonotic risk will be reduced. The communication strategy of the project is not focussing on individual citizens, but addresses organisations representing the ideas and feelings of citizens (e.g. animal welfare organisations). As all partners already have close contacts with these organisations on national level, their input is guaranteed. During the course of the project specific deliverables are allocated to communicate, present results and discuss any issue that is relevant to the project.

It is known that housing systems with litter and more freedom of movement for the birds have elevated dust levels, that are harmful for people working in these dusty environments for substantial periods of time. Some negative effects on bird health are also expected. In addition, alternative housing systems may contribute more to environmental pollution. As far as these issues affect bird welfare, they will be dealt with in the LayWel project. Finally egg production in enriched cages and alternative systems will also have economic consequences. However human health, environmental pollution and economic aspects are not within the scope of the LayWel project.

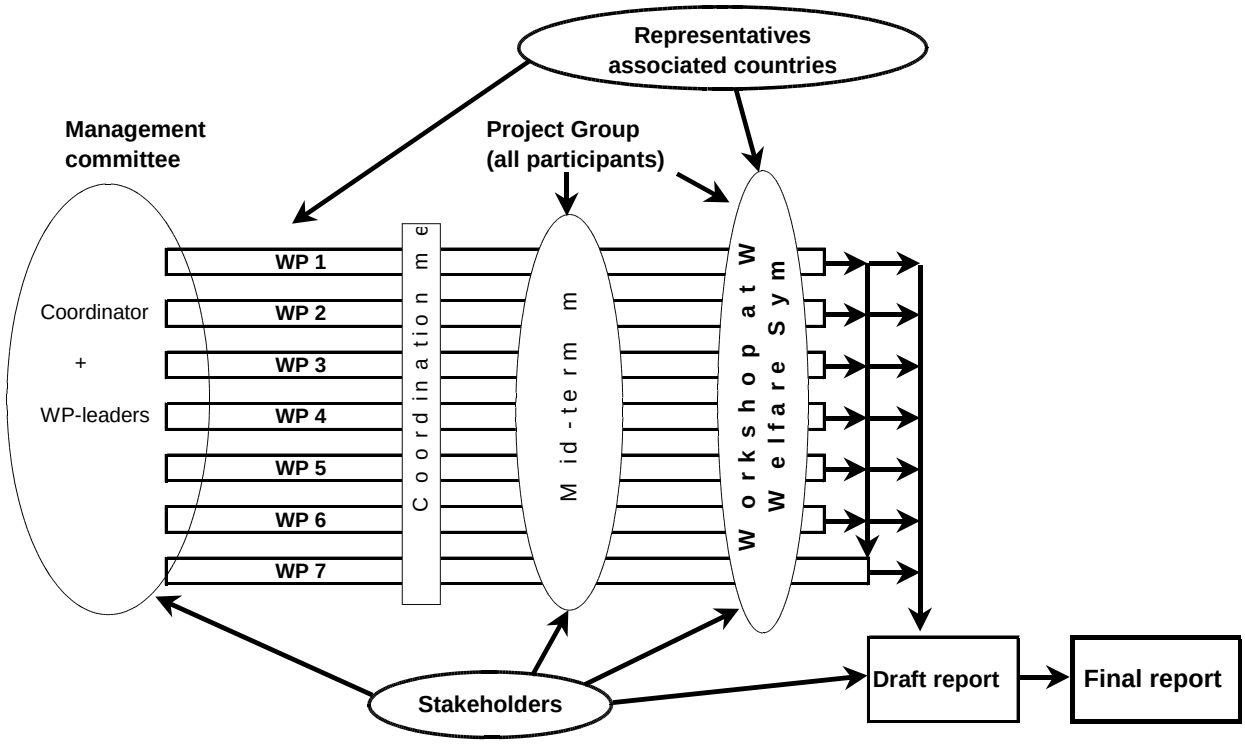
14. Project management and exploitation/dissemination plans

15.Project Management

Organisation and management

The overall co-ordinator of the project will be Dr H.J. Blokhuis (ID-Lelystad). He will be assisted by ir. Th.G.C.M. Fiks - van Niekerk (PV-Lelystad). Together they form the coordination team.
Frequent communication is essential for the smooth running of the project and this will be facilitated by the existing professional collaborations between the partners. Regular communication will be maintained by telephone and e-mail contact and meetings will be held during the project to discuss progress. By connecting these meetings to international poultry events (congresses, seminars, etc.) cost will be reduced and time will be spent economically, while promoting wider consultation and dissemination of the results.

Organisation and management structure:



In the figure the management structure of the LayWel project is clarified. The project contains 7 work packages (WP), that reflect the 7 areas the LayWel project is focussing on. An 8th WP can be identified, being the coordination of the project. Each WP has a WP-leader, who is responsible for the coordination and management of that WP. The WP-leaders are chosen for their expertise in the field and their experience with international projects. All project partners participate in more than one WP to ensure a European-wide focus.
The WP-leaders and the coordinator form a management committee that meets at the start of the project and four more times to coordinate the LayWel-project. One meeting will be held only with members of the management committee at about ¾ of the first year. The next meeting will be combined with a meeting of the complete project group and the stakeholders to evaluate the progress of the project. The third meeting will be combined with the WPSA Poultry Welfare Symposium. The fourth meeting will be combined with the meeting held for WP7 to evaluate welfare. The final draft will be presented in a meeting with stakeholders. After discussing and integrating their comments, the report will be finalised.

Meetings with representatives of associated countries will be mainly through existing contacts. Also many WP-leaders are member of Working Group 9 (Poultry Welfare) of the WPSA where associated candidate countries are represented. The group meets twice a year, making contacts with associated countries easy.

Another meeting that has already been planned with scientists of many countries is the World Poultry Congress in Turkey (2004), organised by the WPSA - Turkish branch.
The WPSA Poultry Welfare Symposium in 2005 in Poland is chosen as a general meeting with stakeholders and representatives of associated countries, because previous symposia were attended by a very wide range of people (students and scientists from all over the world, many representatives of animal welfare organisations and national and European governments). Therefore, it offers an excellent opportunity to organise a Workshop and discuss the results of the different WPs with both scientists from EU-countries not present in the LayWel project and scientists from associated countries. As in 2005 the meeting is in Poland, the expectation is that many eastern European countries will be present, making a balanced feed-back possible.

Decision making structures

The management committee will monitor the progress of the project and will decide if slight modifications of the plans are needed. If no consensus can be established, the decision will be made by majority of votes. If this doesn't lead to a conclusion the project co-ordinator will decide. Major decisions will always be made after discussion and in agreement with the European Commission.
To keep the project focussed on the strategic objectives of the task frequent contacts with stakeholders are required. Stakeholders are not only members of the European Commission, but also representatives of the industry (COPA), animal welfare groups (Eurogroup) and other groups of public interest.
After the first year a meeting with the stakeholders and the management committee will be organised and interim results will be presented. Based on this meeting minor adjustments can be made in the project-programme. Directly after this meeting an interim report with preliminary results will be available for the European Commission.
The WP-leaders will be responsible to maintain relevant contacts with representatives of associated countries and will have them review draft reports. Many of these contacts are already formalised through other projects of the participating institutes.
After the WPSA-meeting the management committee will meet to evaluate welfare in the different systems, as is part of WP7, and comments and additional information obtained at the WPSA-Symposium will be incorporated.
Near the end of the project a second meeting with the stakeholders will be held to present and discuss the draft report. Based on this meeting the final modifications will be made to the draft report

Risks

Partners are chosen for their proven reliability in international projects. If one, for some reason, can't perform a task, colleagues will take over.
Although partners do have their own unique expertise, they also have some common fields of interest, which will be an advantage to cover for unforeseen problems. If one of the partners is not able to perform a tasks allocated to him, there is the possibility to ask one or several of the other partners to substitute. If the time schedule is in danger other partners may be asked to help.
In this way the risk for missed milestones is minimised. If however any unforeseen problems arise, that can't be solved in the above mentioned way and if this makes it impossible to finish certain deliverables, the mid-term meeting with the stakeholders will be used to discus the problem and possible solutions. Based on this meeting the management committee will make an adjusted plan for consideration by the Commission.

16.Plan for using and disseminating knowledge

Management of knowledge

Partners have already signed a confidentiality agreement to enable open discussion among partners and to reduce the risk for arguments between partners to a minimum. Partners are obliged to keep sensitive information obtained in the LayWel project confidential and refrain from patent arguments with other partners. The confidentiality agreement sets clear rules for all partners with regards to intellectual properties, innovations and patents, within the terms of the LayWel contract with the European Commission
.

For the duration of the project and ten years thereafter partners are not allowed to use confidential information obtained within the project for other purposes than those necessary for the project or by mutual agreement. Notwithstanding this restriction, partners are free to publish their own research results, obtained through the LayWel project, as far as this does not affect the LayWel project. No patent-issues are foreseen.

Exploitation and dissemination plan

The main output of the project will be reports and papers. The following plan has been made to ensure that this information is available for all stakeholders. A stepwise dissemination is foreseen, as draft information will not be distributed too widely to prevent confusion with the final work. However, the request of the Commission for preliminary results has been taken into account.
A halfway meeting with stakeholders is foreseen, in which preliminary results will be presented and discussed. Directly after this meeting the Commission will be provided with a midterm report, including the preliminary results presented at the stakeholders meeting, a management report concerning the progress of the project and a report of the discussion with the stakeholders.

Papers with the results of the different WPs will be presented in a workshop at the 7th European Poultry Welfare Symposium, that will be held in Lublin in Poland in 2005. This symposium is organised by the WPSA Working Group 9 on Poultry Welfare. They have chosen to organise the event in Poland, because this facilitates that many representatives of new member states will attend the meeting. The symposium will serve as an appropriate and up-to-date source of information on European Poultry Welfare for these countries and as a means to present the results of their research and thus inform western European countries about their special issues.
Apart from a workshop at the European Poultry Welfare Symposium the results will be presented in seminars and symposia at the most important poultry exhibitions, e.g. VIV (Utrecht, NL), EUROTIER (Hannover, D), Rennes (F), Forli (I). The first two exhibitions are important for Europe including Eastern Europe, the Middle-East, Africa and Asia, while the last two address different regions of Europe.

Confidential draft reports and draft reports will be sent for review to stakeholders from associated candidate countries/new member states and, possibly, other independent experts. Apart from this they will, generally, only be available for the participants of the project (plus the Commission Services). After the first review a meeting will be organised with stakeholders and presentations of all reports will be given. Efforts will be taken to ensure participation not only of specialised stakeholders, but also of a non-specialised general audience in this meeting. The results and conclusions will be discussed in technical detail as well as with regard to the wider societal implications. This discussion will lead to the final review of the report. Shortly after this meeting the Commission will be provided with a report of the meeting, a final management report and the final report of the LayWel project.
The final report will be public. The distribution and availability of the report will be according to ideas and guidelines of the Commission. In co-operation with stakeholders, especially animal welfare organisations, it will be discussed how to make the information in the report more available to the public.
Several papers in scientific journals are foreseen, both review papers as well as publications of new research results. Proceedings of the WPSA Poultry Welfare Symposium are public. Thus, a widespread dissemination of the results of the LayWel project will be ensured.

17.Raising public participation and awareness

Public participation and awareness on the issue of the welfare of laying hens is easy to achieve, but to realise it on purely scientific basis without emotions taking the lead, is very difficult. On this part the help of animal welfare organisations and other stakeholders with public contacts is necessary. They have valuable contacts to ensure public participation. Also the tools the European Commission supplies to support this type of actions are necessary. The meetings with the stakeholders should be used to discuss this matter and make a plan to get the public into the issue in a sound way. This requires several actions:

- The LayWel project will not only focus on scientific publications, but also on more popular publications. The help of the European Commission (tools, guidelines) will be used.
- In the dialogues with animal welfare organisations these popular publications will be discussed.

– For the distribution of these publications all stakeholders will be asked to distribute the information among their members and other people. Also other ways of dissemination of results will be discussed with the Commission. For example, a website, where all items concerning welfare of laying hens are discussed in a short and clear manner.

18. Workplan - for full duration of the project

19. Introduction - general description and milestones

Activities

The project contains only RTD and Management activities. The workplan is divided into 7 workpackages (WP1-WP7) containing RTD-activities, focussing on the different aspects of importance to welfare of laying hens in various housing systems. An 8th WP is formulated overall management activities.

Structure and the overall methodology used to achieve the objectives

The choice for the 7 WPs has been based on the description of task 7 of area 8.1.4 of the Call of FP6. In this task the following specific areas of interest are mentioned: behaviour, health, physiological stress indicators and productivity, including egg quality. It is also mentioned that the welfare impacts shall be assessed for each system described in Directive 1999/74/EC and Regulation 1274/91, as amended. Furthermore the task stresses that the report should produce data from the point of view of animal welfare.

As requested in task 7 of the Call, attention will be paid to:
- the advantages of the changes for the welfare of the laying hen as well as possible disadvantages;
- aspects that require further improvements
- gaps in the knowledge of welfare of laying hens.

Within the limited budget, and with the emphasis on the collection of new data, the following inputs are distinguished:
- Specific experiments
- Data from scientific publications
- Data from ongoing research
- Additional observations/measurements in ongoing studies
- Unpublished data from (recently) finished experiments

The 8th WP contains all overall management activities:
- overall management of the project
- contacts with stakeholders
- contacts with associated candidate countries
- realisation of the final report
- dissemination of the results (other than papers in scientific journals, which are part of the research tasks within each WP).

The WPs are subdivided in tasks leading to the main deliverable, being a report. In the Gantt chart the planing of the work and the timing of the different tasks is shown. In a 2-year period a report will be realised presenting the state of the art of the welfare of laying hens in enriched cages and alternative housing systems.
In the Pert chart the relation between the different tasks and WPs are shown. Frequent contacts between partners will ensure an efficient use of information and a close relation between the WPs.

The WP-leaders are responsible for co-ordinating their WP. They will ensure that the information they need is obtained in time, that the milestones are met and the deliverables will be ready in time. They will also keep close contact with stakeholders and associated candidate countries, to make sure that the outcome of their WP will be reviewed and revised according to the information brought in by stakeholders and associated countries. In this way the final outcome of their WP will be widely accepted by the welfare community in the enlarged EU.

In the "List of tasks and contributions" for each WP-task the main partner is identified in addition to the contributions of other partners to the task. The codes 1.1 - 8.3 are used, the first number referring to the WP, the second to the task within this WP. The numbers correspond with the numbers used for the deliverables (D1.1 - D8.3).

Emphasis on enriched cages

The EU-Directive 1999/74/EC deals with unenriched cages, enriched cages and alternative housing systems for laying hens. The first category is included for a restricted period, to enable a progressively implementation of the Directive. After 2012 only two categories will be distinguished: enriched cages and alternative housing systems (deep litter, barn, aviaries, free range).
Article 10 of this Directive states that, To evaluate the Directive the Commission is required to present a report on the various systems for keeping laying hens, in particularly those covered by the Directive. Clearly the LayWel report should focus on both enriched cages and alternatives.
At the time the EU-Directive was implemented, quite some information on alternatives was available. The information on enriched cages was only based on lab studies and no field data were available. This makes it more likely that the part of the Directive dealing with enriched cages needs to be evaluated. After the Directive came into force research has made tremendous efforts in the field of enriched cages and a lot of new information became available. Although there are still many questions left and research will need much more time to fill in the gaps in knowledge concerning this type of housing, the LayWel project will present extensive new information on enriched cages, containing the following information:

- clear definitions of enriched cages, the different variants
- definitions of individual enrichment components, with special focus on litter
- behaviour in enriched cages, with special focus on feather pecking and preference of hens with regard to the various enrichment components
- mortality and health status of hens in cages (including parasites)
- production and egg quality in enriched cages as far as related to welfare of the hens
- management of hens in enriched cages as far as related to welfare of the hens
- integrated welfare assessment (incl. welfare risks)
- advice on possible optimisations of enriched cages
- gaps in knowledge

With regards to the information on alternatives the report produced by the Scientific Veterinary Committee in 1996 forms a sound basis. However, research on alternative housing systems also made a lot of progress, making an update needed. For an objective, scientific sound evaluation of the Directive it is necessary to incorporate information on both enriched cages and alternative housing systems in the final report of the LayWel project. WPs will put special emphasis on the generation of information on enriched cages.

Although in WP1 welfare will be defined independently of the housing system, a substantial part will deal with the welfare of hens in enriched cages and in alternative housing systems. Advantages and disadvantages will be listed for enriched cages and in alternative housing systems and recommendations for optimisation will be formulated for each.

Eastern Europe and countries associated with the EU

New members enter the EU periodically. These countries will have to comply with the European Directives after a certain period of time and this will require major efforts, not only to modify national legislation, but also to get national acceptance of the new regulations. The differences in legislation in this field between member states and other countries are often very large. For both the EU and associated countries a clear dialogue on the topic of animal welfare and more specifically the welfare of laying hens in various housing systems will smooth the path to uniformity in legislation.

Contacts with associate candidate countries have a variety of forms and the frequency of the contacts will differ, but WP-leaders will be urged to frequently discuss matters with these contacts. In a more formalised form representatives of associated countries will be asked to review draft reports. Also they will be invited to the discussion in the workshop held at the WPSA European Poultry Welfare Symposium. Minutes of this

workshop as well as papers presented at this Symposium will be used to incorporate their opinions in the final report.

Stakeholders and industrial involvement

In the LayWel project 7 European countries are represented. National governments and the national egg boards of these countries have strong bonds with the project through their involvement in the research incorporated in this project. Apart from this all partners have extensive dialogues with local animal welfare organisations and with industrial partners. Appendix 1 lists the most important relations.
Companies main interest is to develop successful and accepted enriched cages and alternative housing systems. In the last decades they have found that the best way to achieve their goal is through alliance with independent research institutes testing their products. The partners involved in the layWel project have been co-operating with all main companies involved in poultry production (cage and poultry equipment manufacturer, feed mills, breeder companies) for many years. All companies duly recognise the full scientific independence of the institutes. As all partners have strong and long-term dialogues with these companies resulting in local projects the co-operation in and contribution to the LayWel project is secured.

Milestones

Apart from the milestones formulated within each WP and apart from the above-mentioned seminars at the larger exhibitions, three global milestones can be identified:
- Month 13: The mid-term report with preliminary results of the first year
- Month 18: The proceedings of the WPSA European Poultry Welfare Symposium, containing the papers presented at the Workshop about the LayWel project
- Month 24: The draft report, that will be discussed at the meeting with the stakeholders. Shortly after this meeting the final report will be ready.

List of tasks and contributions

Task	Deliverable title	Main Partner	Contributions
1.1	Draft welfare definition	UHOH	UHOH will carry out this task with contributions of UNIZAR, ADAS and SLU, representing countries with a wide range of views on animal welfare.
1.2	Report on welfare definition	UHOH	With comments on the draft of all partners, UHOH will make the final description with the help of UNIZAR
2.1	Interim report description of housing systems for laying hens	PV-Lelystad	PV-Lelystad will carry out this task, using own information, literature studies, and information from ADAS, INRA, SLU, UHOH, UNIZAR
2.2	Description of housing systems for laying hens	PV-Lelystad	PV-Lelystad will carry out this task, using own information, literature studies, and information from ADAS, INRA, SLU, UHOH, UNIZAR
2.3	Report on housing systems	PV-Lelystad	PV-Lelystad will carry out this task, using the information collected in tasks 2.1 and 2.2
3.1	Co-ordination and documentation of scoring system for bird health and integument	DIAS	DIAS will carry out this task, SLU and UNIZAR will provide information
3.2	Compilation of data on health traits and mortality from lab studies and commercial farms. Data on air condition in poultry houses	SLU	SLU will carry out this task, using own data from various new studies, as well as data provided by ADAS, DIAS, INRA, UHOH, UNIZAR and PV-Lelystad
3.3	Report on health	SLU	SLU will carry out this task, using the information collected in tasks 3.1 and 3.2

4.1	Literature review on bird preferences and enrichement components	UNIVBRIS	UNIVBRIS will carry out this task
4.2	Report on prevalence of feather pecking in various production systems	UNIVBRIS	UNIVBRIS will carry out this task, using published as well as unpublished experimental data and information from WP2, 3 and 5
4.3	Report on substrate needs and preferences	ID-Lelystad	ID-Lelystad will carry out this task, DIAS will provide birds from two lines that differ genetically in level of feather pecking behaviour
4.4	Definitions of behavioural indicators for evaluating substrate quality	ID-Lelystad	ID-Lelystad will carry out this task, using information from tasks 4.1 till 4.3 as well as information from WP1, 3 and 5
4.5	Evaluation of litter quality in enriched cages and alternative housing systems	ID-Lelystad	ID-Lelystad will carry out this task, a part of the observations will be done by PV-Lelystad. Data from (mostly published) studies of UNIVBRIS will be used, as well as new data from INRA and UNIZAR. Information from task 4.4 and WP2 will be used.
4.6	Behavioural function of production systems for laying hens in various housing systems	SLU	SLU will carry out this task, using own data from various studies, as well as new data provided by INRA, UNIVBRIS, UHOH, UNIZAR and PV-Lelystad. Information from task 4.5 and WP2 will be used.
4.7	Report on behaviour	DIAS	Will carry out this task, using the information collected in tasks 4.1 till 4.6
5.1	Check-up list of ongoing studies with regards stress/physiology	INRA	INRA will carry out this task
5.2	Compilation of already available data from published and ongoing studies with regards stress/physiology.	INRA	INRA will carry out this task, using literature and data from own studies, studies from sister institutes (in France and Norway) and from DIAS, UNIVBRIS and UNIZAR. Information from WP1 will be used.
5.3	Compilation of past and new data from current studies with regards stress/physiology.	INRA	INRA will carry out this task, using new data from own studies, studies from sister institutes (in France and Norway) and from DIAS, SLU, UNIVBRIS and UNIZAR. Information from task 5.2 and WP1 will be used
5.4	Report on stress and physiology	INRA	INRA will carry out this task, using the information collected in tasks 5.1 till 5.3 and WP1
6.1	Interim report on production and egg quality	ADAS	ADAS will carry out this task, using own data as well as new data from INRA, SLU, UHOH, UNIZAR and PV-Lelystad. Information from WP1, 2, 3, 4 and 5 will be used as far as this is already available.
6.2	Report on production and egg quality	ADAS	ADAS will carry out this task, using the information of task 6.1 with addition of relevant new information and using the information collected in WP1, 2, 3, 4 and 5
7.1	Report on strengths and weakness of different systems	UNIVBRIS	UNIVBRIS will integrate the information obtained from all other WPs and makes an overall assessment of the impact of different housing systems on the welfare of laying hens. All partners will participate in this task.
7.2	Procedure manual for farm audit	UNIVBRIS	UNIVBRIS will carry out this task, using the information of all other WPs
8.1	Co-ordination meeting	ID-Lelystad	ID-Lelystad will organise two meetings with the partners to discuss the progress of the project
8.2	Meeting stakeholders (incl. commission) and mid-term report	ID-Lelystad	ID-Lelystad will organise two meetings with stakeholders to discuss the progress of the project and will make a mid-term report
8.3	Final report	PV-Lelystad	PV-Lelystad will combine all reports of all other WPs to the final report

20. Work planning and timetable of the different WPs and their components (Gantt chart)

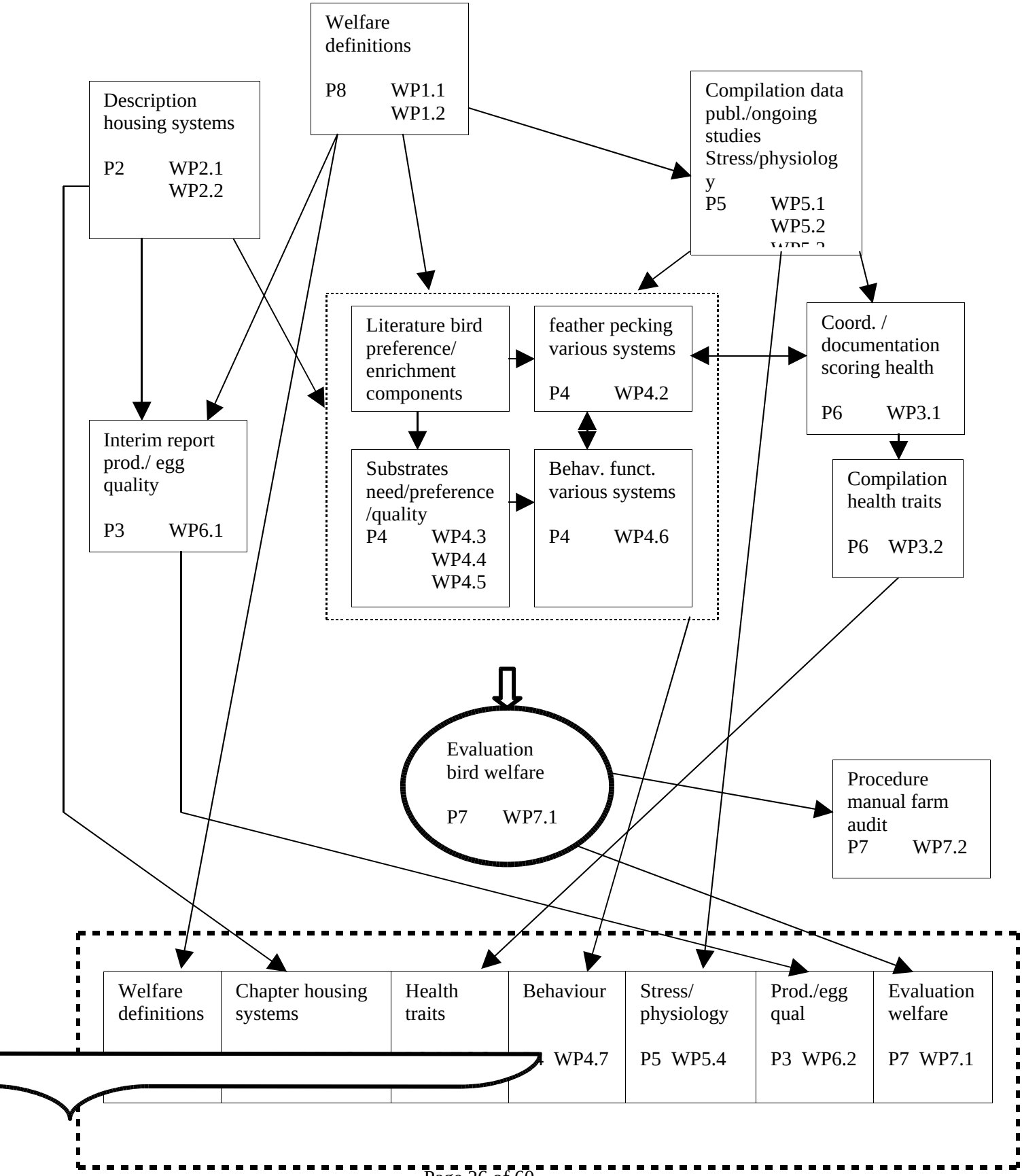
(the numbers in the column WP correspond to the numbers of the tasks and deliverables)

WP	Task	Month:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1.1	Draft definition welfare																									
1.2	Report on welfare definition																									
2.1	Interim report description of housing systems																									
2.2	Descript. housing systems																			X						
2.3	Report housing systems																									
3.1	Coord./document. scoring system health+integument																									
3.2	Comp. data health + mortality+air condition henhouses																			X						
3.3	Report on health																									
4.1	Literature review on bird preferences/enrichm. comp.																			X						
4.2	Report prevalence feather pecking in various systems																			X						
4.3	Report on substrate needs and preferences																			X						
4.4	Defin. behav. Indicators evaluating substrate quality																									
4.5	Evaluation of litter quality in various housing systems																			X						
4.6	Behavioural function of various housing systems																			X						
4.7	Report on behaviour																									
5.1	Check-up list of ongoing studies stress/physiology																									
5.2	Compiltion data (publ./ongoing studies) stress/phys.																									
5.3	Compiltion data (current studies) stress/physiology																			X						
5.4	Report on stress and physiology																									
6.1	Interim report on production and egg quality																									
6.2	Report on production and egg quality																			X						
7.1	Evaluation welfare																			X						
7.2	Procedure manual farm audit																									
7.3	Report with model for evaluation welfare																									
8.1	Coordination meetings																									
8.2	Meeting stakeholders (incl. mid-term report)																									
8.3	Composition and publication final report																									

X = presentation (paper of poster) at WPSA European Poultry Welfare Symposium in Poland

21.Grap] Final report welfare implications of changes in production systems for laying hens

(P= Partner leading the WP
WP=Workpackage; number indicates WP-task)



22. Workpackage list /overview

WP No	WP title	Lead contractor No	Person-months	Start month	End month	Deliv-erable No
WP1	Laying hen welfare: definition and indicators	8	3.8	0	12	D1.1 D1.2
WP2	Description of housing systems for laying hens	2	4.5	0	20	D2.1 D2.2 D2.3
WP3	Health	6	9.7	0	23	D3.1 D3.2 D3.3
WP4	Behaviour	4	26.7	0	23	D4.1 D4.2 D4.3 D4.4 D4.5 D4.6 D4.7
WP5	Physiological stress indicators	5	14.3	0	23	D5.1 D5.2 D5.3 D5.4
WP6	Productivity and Egg quality	3	11.8	0	23	D6.1 D6.2
WP7	Integrated welfare assessment (incl. welfare risks)	7	9.8	13	24	D7.1 D7.2
WP8	Project management and coordination	1	5.7	0	24	D8.1 D8.2 D8.3
	TOTAL		86.3			

23.Deliverables list

Deliverable No	Deliverable title	Delivery date	Nature	Dissemination level
D5.1	Check-up list of ongoing studies with regards stress/physiology	1	O	PP
D4.3	Report on substrate needs and preferences	6	R	PP
D1.1	Draft report on welfare definition and welfare indicators.	6	R	PU
D4.4	Definitions of behavioural indicators for evaluating substrate quality	7	R	PP
D1.2	Report with consensual version of welfare definition and welfare indicators	12	R	PU
D2.1	Interim report description of housing systems for laying hens	12	R	PP
D3.1	Co-ordination and documentation of scoring system for bird health and integument	12	R	PP
D4.1	Literature review on bird preferences/enrichm. comp.	12	R	PP
D4.2	Report on prevalence of feather pecking in various production systems	12	R	PP
D5.2	Compilation of already available data from published and ongoing studies with regards stress/physiology.	12	R	PP
D6.1	Interim report on production and egg quality	12	R	PP
D2.2	Description of housing systems for laying hens	18	R	PP
D3.2	Compilation of data on health traits and mortality from lab studies and commercial farms. Data on air condition in poultry houses	18	R	PP
D5.3	Compilation of past and new data from current studies with regards stress/physiology.	18	R	PP
D4.5	Evaluation of litter quality in various housing systems	19	R	PP
D8.1	Co-ordination meeting	9+20	O	PU
D2.3	Report on housing systems	20	R	PU
D4.6	Behavioural function of production systems for laying hens in various housing systems	21	R	PP
D3.3	Report on health	23	R	PU
D4.7	Report on behaviour	23	R	PU
D5.4	Report on stress and physiology	23	R	PU
D6.2	Report on production and egg quality	23	R	PU
D7.1	Report on strengths and weakness of different systems	23	R	PU
D7.2	Procedure manual for farm audit	24	O	PU
D8.2	Meeting stakeholders (incl. commission) and mid-term report	13+24	O	PU
D8.3	Final report	24	O	PU

24.Workpackage descriptions

WP number	1	Start date or starting event:	1-1-2004

Participant id	ADAS	SLU	UHOH	UNIZAR			
Person-months per participant:	0.3	0.1	2.4	1.0			

Objectives

The perception of welfare in laying hens varies among the countries of the EU and social groups within countries. Some attempts have been made to come to a consensus around certain points and issues of the definition of animal welfare, but these attempts are mainly focussed of the perception in Northern Europe. The objective of WP1 is to formulate a generally throughout Europe accepted definition of animal welfare as a base for the LayWel project. The relevance of parameters to measure welfare will be indicated.
The result of this WP will be used as a base for the other WPs.

Description of work

UHOH will collect and compile definitions of welfare in laying hens. To ascertain a European-wide input, UNIZAR will bring in the point of view of southern countries and ADAS and SLU will bring in the view of their countries. ADAS and SLU will also bring in their experience with regards to welfare definitions and welfare parameters.
The draft welfare definitions and indicators will be presented to the participants of the project, as a basis of open discussion by e-mail. The result of the discussion will be summarised, and a consensual definition will be presented.

Deliverables

1.1: Draft welfare definitions and indicators.

1.2: Consensual version of welfare definition and welfare indicators.

Milestones and expected result

In month 6 the draft version of the welfare definitions and indicators will be ready.

In month 12 the final welfare definition and indicators will be ready.

WP description (full duration of project)

WP number	2	Start date or starting event:			1-1-2004		
Participant id	PV-Lelystad	ADAS	INRA	SLU	UHOH	UNIZAR	
Person-months per participant:	2.2	0.3	0.1	0.1	0.8	1.0	

Objectives

Not all housing systems have the same impact on bird welfare. Aspects that are well controlled in some systems may be more critical in other systems. In order to harmonise terminology and to be able to evaluate welfare on the basis of system criteria and provisions (as will be done in WP7), it is necessary to identify these systems in more detail than the three categories defined by EU-Directive 1999/74/EC. Further categorisation will be based on clear criteria. All WP's will use these categories in there reports, making the results of the different WPs compatible.
The objective of WP2 therefore is to identify in detail the different categories of housing systems for laying hens and to describe the range of variety within these categories, to facilitate the further process of the project.

Description of work

Part 1: PV-Lelystad will make an inventory of housing systems, concentrating on enriched cage systems, for laying hens that are used in Europe. Information for this will also be provided by ADAS, INRA, SLU, UNIZAR and UHOH. All systems that are of any significance or will be in the future, will be described (short description, cross section, photograph) and categorised. To start with the following categories will be distinguished: Unenriched cages, Enriched cages, Traditional deep litter, Multi-tiered aviaries, Outdoor/free range (including ecological/organic production, wintergarten). Each category will be described with the characteristics and possible range in lay-out.

Deliverables

2.1: Interim report with description of housing systems and categories of housing systems, that can be used in the other WPs.

2.2: Report with description of housing systems and categories of housing systems.

Milestones and expected result

In month 9 the collection all information about housing systems for laying hens will be finished. Based on the outcome of this, it will be decided whether the proposed system-categories are valid and, if not, they will be adjusted accordingly. In month 12 the first draft of the system-descriptions will be ready.

In month 23 the final result of WP2 will be a report concerning housing systems

WP description (full duration of project)

WP number	3	**Start date or starting event:**				01-01-04	
Participant id	PV-Lelystad	ADAS	DIAS	INRA	SLU	UHOH	UNIZAR
Person-months per participant:	0.4	0.3	2.9	2.0	1.3	0.8	2.0

Objectives

Health traits including mortality are essential parameters in the assessment of the welfare of laying hens in different housing systems. The overall objective of this WP is to process and compile relevant data from experimental units and commercial farms on a wide range related to the health of laying hens in different housing systems. It is expected that these data will provide valuable information. Information on air condition in poultry houses will also be collected in relation to its effect on poultry welfare.

This WP will report information on health traits from a range of countries, which was not available at the time of the 1999 Directive and thus, will serve as substantial and additional information to the SVC Report in 1996 (NN, 1996). This applies especially to enriched cages of various designs and group sizes in commercial farms as well as in labs. Comparisons of this system to other alternative systems as well as to unenriched cages will be reported on. Data on floor systems with free range in commercial use will also be available.

Description of work

Information will be collected from previous studies to set a basis. New research will provide data covering welfare traits both from lab studies as well as from commercial farms. The origin of data is by scoring animals at the site and autopsy in labs in combination with using records of mortality rates. Air condition in the poultry house will be measured as regards contaminants like dust as well as levels of detrimental gases. SLU will gather and compile data for the scoring system for bird health and integument assisted by DIAS and UNIZAR. For the information on health traits and the registrations of air condition in commercial units SLU will be assisted by ADAS, DIAS, INRA, UHOH, UNIZAR and PV-Lelystad. A study like this has not been done before, as the data will come from several countries and will be comparable as they will all use the same systematic for scoring health and the same criteria for the various housing categories (as defined in WP2).

Deliverables

3.1: Co-ordination and documentation of a scoring system for bird health and integument.

3.2: Compilation of data on health traits and mortality from lab studies and commercial farms. Data on air condition in poultry houses as far as they relate to bird health.

3.3 A report will be produced on a scoring system for bird health and integument and actual health traits and mortality in various systems for layers hens in commercial and semi-commercial conditions in different countries as represented by the partners.

Milestones and expected result

In month 12 the report on documentation of the scoring system will be ready.

The collection of health traits and air conditions from the literature will be finished in month 12. Collection of data from lab studies and commercial farms can start earlier. Based on the preliminary information in month 12 and the information obtained from WP1 and WP4.2, the remaining time until month 18 will be used to collect missing information.

A complete report will finalise WP3 in month 23.

WP description (full duration of project)

WP number	4	**Start date or starting event:**				01-01-2004		
Participant id	ID-Lelystad	PV-Lelystad	DIAS	INRA	SLU	UNIVBRIS	UHOH	UNIZAR
Person-months per participant:	7.7	3.0	3.0	1.9	2.0	2.5	4.0	2.6

Objectives

The objective of this task is to gather data, published, unpublished as well as data from ongoing experiments, concerning the needs, preferences, distribution, behaviour and use of facilities by birds housed in experimental and commercial egg production systems across Europe. Various hybrids kept at different group sizes and stocking densities will be the subjects of the investigations. This will include information about spacing patterns, use of feeders, drinkers, litter areas, perches and nest boxes. More specifically the objectives are as follows.

-Literature review on bird preferences and enrichment components
-Investigation of the prevalence of feather pecking in various production systems
-Substrate needs and preferences
-Definition of behavioural indicators for evaluating substrate quality
-Evaluation of litter quality in enriched cages, aviaries and free-range systems
-Behavioural function of production systems for laying hens: Enriched cages, aviaries

Description of work

In task 4.1 and 4.2 UNIVBRIS will make a review on bird preference and enrichment components. A substantial part will be new data. Also a report will be made on the prevalence of feather pecking in various systems. This has never been done in this way: there will be data from several countries and the systematics for collecting are the same, making a comparison and compilation of data from several countries possible. Data will come from ID-Lelystad, DIAS, SLU and UNIVBRIS.

Based on the material collected, ID-Lelystad will choose and fine-tune a method (task 4.3) and will use it to determine behavioural preferences in laying hens. Based on current knowledge the consumer demand approach in combination with an operant conditioning test or learned response task will probably be used. In this approach the hens have to work to enter compartments with different types of substrate, or to work to enter compartments with different substrate characteristics, e.g. depth or size. The price, i.e. the amount of work the hen has to pay to enter the compartments with the different substrates will be varied so that we are able to rank the different substrates in terms of importance to perform a certain behaviour. For these tests DIAS will provide hens of genetic lines selected on feather pecking behaviour as well as hens of control lines.

In task 4.4, hens will be housed on different types of substrate, of which we presume that they are preferred or not preferred to perform dustbathing or pecking and scratching. ID-Lelystad will include this in the experiments as described above. By observation of the behaviour of the hens they will define the important criteria of the behaviour for assessing substrate quality in task 4.5. This will be compared with the knowledge available from literature, such as the sequence of dustbathing behaviour and targeting of pecking behaviour.

In task 4.5, ID-Lelydtad will evaluate litter quality in different systems. The behavioural measures defined in task 4.4 will be used to evaluate quality of substrate for dustbathing and pecking and scratching. Different types of aviaries and organic systems with different substrate types will be available at experimental and commercial farms. PV-Lelystad will carry out observations in enriched cage systems at commercial farms and sister institutes. As they now have available measures to evaluate the quality of substrate for dustbathing and pecking and scratching, they will carry out behavioural observations in these different systems and assess the quality of the litter provided with respect to the performance of dustbathing and pecking and scratching. Additional data from UNIVBRIS, INRA and UNIZAR will be obtained.

For task 4.6 the main activities will be recording behaviour in a range of egg production systems as well as investigations of more specific parts of these systems, i.e. area for roosting, feeding, exploration and dustbathing, nesting and so on. The nature and severity of abnormal behaviours and damaging allo-pecking (feather pecking and cannibalism) will be monitored. SLU will carry out this task using their own data and data from UNIVBRIS, UHOH, INRA, UNIZAR and PV-Lelystad.

Methodology used to achieve objectives

Standard behavioural recording methods, such as all occurrence sampling on flock- as well as focal animal level will be used. Scan sampling will be used, f. ex. when recording spatial distribution of the hens during the day (bird location by age along the day: nest, litter box, floor, perches). Recording will be by direct observation or observations from video tape recording. Recording of work load in an operant conditioning set-up can be automatic and computer controlled. Other examples of methodology are the sequence of behaviour, the frequency, direction and severity of pecking.

Deliverables

4.1: Literature review on bird preferences and enrichment components

4.2: Report on prevalence of feather pecking in various production systems

4.3: Report on substrate needs and preferences

4.4: Definitions of behavioural indicators for evaluating substrate quality

4.5: Evaluation of litter quality in various housing systems

4.6: Behavioural function of production systems for laying hens in various housing systems

4.7: Report on behaviour

Also papers will be published from tasks 4.1, 4.2, 4.3, 4.5 and 4.6

Milestones and expected results

The results of task 4.3 and 4.4 are expected in month 6 and 7 and are needed for task 4.5.

All results will be available in month 21, making it possible to start task 4.7.

The report will be ready in month 23.

WP description (full duration of project)

WP number	5		**Start date or starting event:**		1-1-2004		
Participant id	DIAS	INRA	SLU	UNIVBRIS	UNIZAR		
Person-months per participant:	2.0	6.0	0.8	2.5	3.0		

Objectives

The objective of the different partners in this WP is to investigate physiological indicators of stress for the assessment of welfare of laying hens. These indicators will be obtained in various experimental and commercial type conditions which apply for the production of eggs in Europe, e.g. different genotypes, management conditions, stocking densities, group sizes, etc. These sets of data will be highlighted with data related to other biological indicators of stress obtain in the other WP.
The physiological status of the birds will be assessed at the start of lay as well as later in the laying cycle using, as far as technically feasible, the same physiological parameters in the various experimental contexts.

Description of work

In this WP INRA will collect data on various genotypes used in the different European countries (light white or brown hens), in different management conditions (conventional and furnished cages, aviaries), stocking density (550 cm^2 minimum), group size (5 to over one thousand), etc. Ideally, the physiological status of the birds would be assessed at the start of lay as well as later in the laying cycle. Due to the short duration of the project regarding to the age at first egg (approximatively 20 weeks) and duration of the reproductive period (1 year), it is of importance to anticipate whenever possible, therefore most of the measurements will be realised from samples collected in ongoing studies. Consequently most samples would be available for analysis by month 12, most biological analysis completed by month 18 and deliverables ready in month 23. These experiments will be run by UNIZAR, INRA (2 locations), ININVBRIS, SLU, DIAS. INRA will also obtain data from experiments in Norway. The number of birds involved in each of these trials will range from 250 and 3200 and the number of samples collected exceed 10.000 alltogether. As far as technically feasible, the same physiological parameters will be widely used in the various experimental contexts:
- Basal and following challenge corticosterone concentrations in the blood,
- Corticosterone metabolites concentrations in faeces,
- H/L ratio,
- Humoral Responses.

Most activities in WP5 consist of research, with a basis of literature review (task 5.1 and 5.2) following data collection and analysis, realisation of experimental studies (task 5.3), report writing related to the previously listed objectives (Task 5.4) . INRA will perform the literature review and the compilation of the research data. INRA, DIAS, SLU, ININVBRIS and UNIZAR will collect the data on physiological paramaters.

Methodology used to achieve objectives

Standard laboratory procedures will be used: RIA for corticosterone and faecal metabolites, standard numeration on blood smears, hemagglutination or specific ELISA for antibody measurements.

Experiments and data collection:

INRA: comparison of commercial enriched cages (large group size) and standard cages (Isabrown genotype); Corticosterone, H/L samples and antibodies. From a sister institute in Norway similar data will be obtained from a comparison of furnished cages and standard cages with different genotypes. From a sister institute in France (AFSSA) similar data will be obtained from a comparison of commercial standard cages and aviaries (Isabrown genotype).
DIAS: blood corticosterone samples from layer lines divergently selected on feather pecking.
UNIVBRIS: experimental flocks raised in single-tier aviaries differing in stocking density, group size and management conditions; organ weight, H/L ratio, faecal corticosterone.
UNIZAR: comparison of enriched and standard cages (different genotypes); plasma and faecal corticosterone, antibodies, H/L-ratios.
SLU: Comparison of commercial enriched cages (small group size; different genotypes); H/L-ratios.
The expectation is that most samples will be available for analysis at the end of the first project year, most biological analysis completed halfway the second project year and the deliverables will be ready in month 23. INRA will also be responsible for the compilation of data, the writing of the (draft) report.

Deliverables

5.1: Check-up list of ongoing studies with regards stress/physiology

5.2: Compilation of already available data from published and ongoing studies with regards stress and physiology.

5.3: Compilation of past and new data from current studies with regards stress/physiology.

5.4: Report on stress/physiology

Milestones and expected results

In month 1 the check list of ongoing studies and physiological parameters that can be checked will be available and a start can be made with task 5.2.

A draft report of data from task 5.2 will be due to in month 12 and can be used in WP4 and WP6. The result task 5.2 and of WP1 will be used to decide on the further compilation of data.

A complete manuscript as a report will finalize WP3 in month 23.

WP description (full duration of project)

WP number	6	**Start date or starting event:**			1-1-2004		
Participant id	PV-Lelystad	ADAS	INRA	SLU	UHOH	UNIZAR	
Person-months per participant:	0.1	2.9	0.3	0.5	4.0	4.0	

Objectives

The objective of WP6 is to describe the productivity and egg quality traits observed in enriched cages of three designs and also in barn systems, using laying hens of a number of breeds and at a range of stocking densities, over full laying cycles and up to commercial flock scale. It will also consider how the data contribute to our knowledge of welfare, and we will discuss the suitability of various productivity variables as welfare indicators. Information and data from PV-Lelystad, INRA, SLU, UHOH and UNIZAR will also contribute to WP6.

The data we will use will be quantifiable and will relate to pre-determined variables. Most of these data will come from replicated scientific studies and will be subject to statistical analysis and verification.

Sub-objectives are:

- Measure egg production, egg weight, egg output, bird body weight, egg quality, second quality eggs, feed intake and mortality in conventional cage systems, enriched cages, barn systems and free range systems. Report in tables and graphs.
- Report on the connection between production data and the welfare indicators identified in WP1.

Description of work

WP6 involves the collection, analysis and interpretation of data and information from existing research projects, and the bringing together of that material into a collective form, enabling comparisons between egg production systems in different Member States.

A number of partners will contribute. From ongoing projects ADAS has access to data from three flocks of laying hens at ADAS Gleadthorpe (totalling 6,600 birds) and one flock of laying hens at a commercial partner's site (totalling 7,600 birds). Data from other projects, including data derived from barn egg systems, has covered aspects of egg quality, nestbox hygiene and microbiological contamination of egg shell surfaces. UNIZAR will assist ADAS in WP6 and will provide similar material and data to ADAS, derived from two types of enriched cage systems.

INRA will provide production data and egg quality data from aviaries, percheries and cage systems in France.

PV-Lelystad will provide production and egg quality data from enriched cage systems, deep litter systems and aviaries. SLU will provide production data from 50 flocks on commercial farms in Sweden and comparative data from deep litter and enriched cage systems.

UHOH will provide production data from different designs of enriched cage and from free range systems (both conventional and organic).

ADAS will collate all data and information provided into a single report in tables and graphs. From WP1 and WP5 information will be obtained on relevant welfare parameters. This information will be combined with the production and egg quality information.

Time schedule: all tasks can begin 1-1-2004 and an interim report prepared by 1-1-2005. A final report can be prepared by 1-1-2006.

Deliverables

6.1: Interim report on production and egg quality

6.2: Report on production and egg quality

Milestones and expected result

In month 9 the interim data from all partners will be collated

A draft interim report will be ready in month 12

The information of WP1 will be available in month 12 and will be needed to start the final task of WP6.

In month 23 the report will be delivered.

WP description (full duration of project)

WP number	7	**Start date or starting event:**			1-1-2005			
Participant id	ID-Lelystad	PV-Lelystad	ADAS	DIAS	INRA	SLU	UNIV BRIS	UH OH	UNI ZAR
Pers.-months per part.:	0.1	0.1	0.3	0.1	0.1	1.0	4.5	1.6	2.0

Objectives

The objective of this Workpackage is to integrate the information obtained from all preceding work packages to make an overall assessment of the impact of different housing systems on the welfare of the laying hen. This will be done by examining the consistency of quantitative data on bird welfare, and by integrating this information with an assessment of the impact of less easily quantified influences.

Conclusions about the overall welfare impact of housing system on laying hen welfare will be made taking account of regional and cultural factors.

Description of work

An overview of the quantitative data available from a wide range of replicated studies and commercial-scale trials in the EU will determine whether health, physiological, behavioural and production indicators of welfare co-vary. The findings from WP3, 4, & 5 will be evaluated as regards to areas of consistency and inconsistency in results relating to bird welfare using correlation and regression techniques and will be put into context with productivity data from WP6. A meeting will be convened for all participants to consider whether some measures are more reliable, robust, valid or important indicators of welfare than others. They will then consider how to apply weighting factors to reflect the relative importance of each measure.

The next stage will be to consider the influence of factors that cannot be easily studied using quantitative methods. Thus, the influence of background treatment effects such as bird genotype, rearing experience, and beak trimming status that may be insufficiently replicated for formal statistical analysis will be considered, together with data on the impact of housing system on the welfare of birds during placement and depopulation. An assessment will be made to determine whether the risk of rare but catastrophic events, such as fire, power failure, or disease that would impact severely on bird welfare, varies across housing system. Lastly, an assessment will be made of how climatic, regional and cultural factors might impact on the welfare of birds housed in different systems. The results will support the definition of a scoring system for the welfare of layers.

Deliverables

7.1: Report on the overall strengths and weaknesses of each defined housing system for laying hens, and detailing the overall welfare impact of each housing system. This report will be the important end-stage of the overall project report and will bring the information of all other WPs together.

7.2: Manual that can be used to audit the welfare of laying hens at a farm level in whatever housing system they are held. The manual will define cut-off points at which welfare is likely to be severely compromised and control procedures that could be implemented to improve welfare in each housing system.

Milestones and expected result

WP7 will start at month 13, when all participants will have collated most of the relevant data needed for the integrated welfare assessment.

The draft report on integrated welfare will circulate to all participants in month 21 and will be completed in its final form in month 23.

The manual for on-farm welfare audit will be developed and revised throughout the second year of the project, and will be ready in its final form at the end of the project.

25.Project resources and budget overview

RTD-Activities
To guarantee a broad and balanced support from the participating European countries the contributions to RTD-activities of the LayWel project have been chosen so that all partners request a similar grant to the budget. In all cases the contributions are distributed over several WPs.

Management cost
Management cost are 7% of the total budget. As most of the management work will be done by the co-ordination team a large part of the management budget is allocated to them.
To enable the WP-leaders to co-ordinate their WP, a part of the management budget is allocated to each WP. As WP 1 and 2 do not requiremuch co-ordination work, these management budgets are smaller. As most WPs combine information from several research institutes and several regions of Europe, it will take efforts to combine the information, draw general conclusions that are supported by all contributers and make the connection to the information collected for the other WPs.
Four meetings are foreseen with the WP-leaders (management committee), two of those being combined with a stakeholders meeting (see below under Dissemination) and one being together with the total project group. Smart choices of the meeting time and place helps partners to make arrangements for additional meetings. RTD activities in the WPs require budget for travelling.
Budget for hosting of the management meetings is put under RTD activities of the co-ordination team (ID-Lelystad and PV-Lelystad).

Dissemination
Dissemination of the results will be done through reports and papers. Most of the budget needed for this activity is incorporated in the costs for RTD activities. The exploitation of the mid-term report and final report is put under RTD activities of the co-ordination team (ID-Lelystad and PV-Lelystad).
Many of the results will be published in scientific journals, the cost for which are not specified but are covered within the RTD-budgets.
Dissemination of the results will also be done through two meetings with stakeholders. Budget is allocated to support travel expenses of stakeholders. Also part of the travel cost of the co-ordination team will be covered (but not for the other LayWel partners). Budget is also foreseen for the organisation and hosting of these meetings. This dissemination budget is put under RTD activities of the co-ordination team (ID-Lelystad and PV-Lelystad).

Balance in budget
As mentioned under RTD activities, partners request an almost equal grant to the budget for RTD-activities. Partners on Additional Cost have lower budgets, but have costs that are not itemised.
As management and dissemination costs are primarily carried out by the coordination team, the budget reflects this division.

26.Project Effort Form

Full duration of project

Project acronym - **LAYWEL**

	ID-Lelystad	PV-Lelystad	ADAS	DIAS	INRA	SLU	UNIVBRIS	UHOH	UNIZAR	TOTAL PARTNERS
Research/innovation activities										
WP 1: Welfare definitions			0.3			0.1		2.4	1.0	3.8
WP 2: Housing systems		2.2	0.3		0.1	0.1		0.8	1.0	4.5
WP 3: Health		0.4	0.3	2.9	2.0	1.3		0.8	2.0	9.7
WP 4: Behaviour	7.7	3.0		3.0	1.9	2.0	2.5	4.0	2.6	26.7
WP 5: Physiological Stress				2.0	6.0	0.8	2.5		3.0	14.3
WP 6: Productivity/eggs		0.1	2.9		0.3	0.5		4.0	4.0	11.8
WP 7: Integrated welfare	0.1	0.1	0.3	0.1	0.1	1.0	4.5	1.6	2.0	9.8
Total research/innovation	7.8	5.8	4.1	8.0	10.4	5.8	9.5	13.6	15.6	80.6
Demonstration activities										
Total demonstration	0	0	0	0	0	0	0	0	0	0
Management activities										
WP 1: Welfare definitions								0.1		0.1
WP 2: Housing systems		0.1								0.1
WP 3: Health						0.3				0.3
WP 4: Behaviour				0.3						0.3
WP 5: Physiological Stress					0.3					0.3
WP 6: Productivity/eggs			0.3							0.3
WP 7: Integrated welfare							0.3			0.3
WP 8: General management	2	2								4
Total management	2	2.1	0.3	0.3	0.3	0.3	0.3	0.1	0	5.7
TOTAL ACTIVITIES	9.8	7.9	4.4	8.3	10.7	6.1	9.8	13.7	15.6	86.3

27. Overall budget for the full duration of the project (Forms A3.1 & A3.2 from CPFs)

28.Management level description of resources and budget.

The tasks in the LayWel project cover laboratory experimentation, desk studies and management. WP 1 and 2 do not require a lot of management. WP3-7 are more complex and do need more management and, therefore, their management budgets are larger.
Although the studies in WPs are allocated to partners that are specialised in these tasks, they will often require contributions of other partners. These contributions are: providing field data, data of ongoing or finished experiments and experimental details on certain topics. As these are only minor tasks, only minor budgets are allocated to these tasks.
All partners have some budget allocated to contribute to WP7. This is for both labour and travel expenses. Four partners have more budget for this WP, to bring in experiences, ideas and specific issues from across Europe Regions reflect different views, cultures and environmental situations (e.g. climate).

Partner 1 is providing the co-ordinator of the LayWel project and will therefore need budget to perform the coordination tasks. Part of the work of the coordinator is to organise the workshop at the European Poultry Welfare Symposium and the final seminar with the stakeholders. For the final seminar budget is needed to cover accommodation cost, travel expenses of the stakeholders and presentation costs. These cost are equally distributed over partner 1 and partner 2 and 50 percent of these cost are requested as a grant to the budget.
Apart from the tasks as coordinator, partner 1 is also involved in WP4. The work consists of research in experimental units, for which mainly labour costs and lab costs are calculated. As partner 4 is also involved in this task, some travel expenses are calculated to meet and discuss the progress of the project.

Partner 2 is assistant co-ordinator and will therefore need budget to perform these tasks. Together with the co-ordinator the workshop at the European Poultry Welfare Symposium and the final seminar with the stakeholders is organised. As mentioned part of the costs for this final seminar are requested as a grant to the budget. Apart from this, partner 2 is WP-leader of WP2. As this WP is more simple to manage that WP3-7, only a minor budget is needed to manage this WP. To perform the tasks of WP2 budget is needed for desk studies and some travel expenses. Partner 2 is also contributing to WP4. The contribution exists of field studies, requiring labour and some travel expenses. Partner 2 will also have some minor contributions to WP3 and 6, requiring some budget for labour.

Partner 3 has his major task in WP6, where he is WP-leader and is also collecting most of the data. This requires both labour cost, travel expenses and some cost for experimental units. As the WP is one of the more complex ones, requiring a lot of input from other countries, the budget for coordination is larger than for WP1 and 2. As partner 3 has access to many field data for WP2 and 3, budget is planned for those contributions, mainly covering labour cost.

Partner 4 is WP-leader of WP4, which is complex and therefore has a management budget equal to that for WP3-7. Partner 4 is also carrying out experimental work for WP4, requiring labour and lab facilities. Apart from this partner 4 has major contributions to WP3 and 5, requiring mainly labour.

Partner 5 is specialized in the work for WP5, but will also provide experimental and field data for WP3, 4 and 6. As WP-leader of WP5 partner 5 will need budget to manage this WP. The RTD budget is needed for both experimental work and desk study. The contributions for the other WPs are needed to cover for labour cost.

Partner 6 has a long history in experimental work in the field of WP3, and therefore has become the WP-leader of this WP. Apart from the management budget allocated to this WP, Partner 6 will need RTD budget for both experimental work and desk studies. As partner 6 is one of the major authorities with regards to enriched cages and can provide many data, collected both on experimental farms and in the field, budget is needed to cover labour to collect these data and contribute to WP 4, 5 and 6. Also some extra labour budget is needed for WP7 as partner 6 can bring in the issues of the Northern region of Europe.

Partner 7 has its major expertise in the work that needs to be done for WP7 and will coordinate this as WP-leader. Partner 7 will need management budget to coordinate this WP. The majority of the RTD budget will

be spent to cover labour costsin WP7. Besides this partner 7 will also contribute to WP 4 and 5 with basic research, requiring mainly labour.

Partner 8 is also specialised in basic research and will manage WP1. A minor budget is required to cover for labour cost. Besides this, budget is needed for the RTD work for this WP, to cover for labour cost. The contributions to WP4 and 5 will consist of the collection of experimental and field data. For WP7 partner 8 is the representative of the Eastern part of the European Union. Contacts with eastern European associated countries will be organised as described earlier.

Partner 9 will have its main contribution in WP6, being experimental work and the collection of field data. The input of this information in the project is crucial, as partner 9 is representing the southern region of Europe and thus will bring in essential information with regard to culture, ideas, and environmental issues. The completely different climate may influence technical results dramatically, which makes it necessary to collect both experimental and field data on a variety of aspects. Partner 9 will need budget for labour to collect these data for the other WPs as well. For WP7 Partner 9 is the representative of Southern Europe.

In appendix 1 a more detailed description of the facilities per partner is given. All partners have research facilities available with housing systems for laying hens.

29.Ethical issues

Widespread public concern has stimulated substantial effort to improve the welfare of farm animals. More specifically, much debate has centred on the development of welfare-friendly housing systems for poultry. The impact of much of the work outlined in this project would be through changes in the housing and husbandry of domestic chicks and laying hens. Here, the main beneficiaries would be:

- the consumer, in increased assurance that poultry welfare was being more effectively safeguarded,
- regulatory bodies through their ability to demonstrate that changes required to enhance poultry welfare were based on sound scientific evidence,
- the birds, through improvements in their environment and consequently their welfare status,
- industry by the potential identification of objective criteria for use in developing housing systems, assessing high standards welfare and through improved bird performance as a result of stress reduction and good health.

Ethical review at EU level

All the birds used in the different experiments will be kept in conditions which comply with EU and national regulations governing the use of animals for research purposes. All possible measures will be taken to prevent or minimise suffering by the animals used for research purposes and all relevant national regulations will be respected. The main goals of the project are to improve the welfare of laying hens and to facilitate the introduction of more "animal-friendly" housing systems. Therefore, it has clear and profound ethical implications.
No research will be conducted that can be related in any way with harmful consequences for animal welfare. The use of animals in the research will be limited to the absolute minimum and if other experimental designs, making the use of animals unnecessary, are possible these will be chosen. Where experiments with animals are carried out, these will be implemented according to the national and European regulations.

30.Other issues

In many countries different areas of agriculture are dominated principally by either males or females. Poultry keeping was a female issue up to the point that enlargement of farms was realised and poultry husbandry then shifted from an additional task to a major task of farmers. Nowadays the majority of poultry farms is managed by male workers, although females still have a substantial contribution. As there is some difference in the perception of male sand females, this may be of influence on the perception of animal welfare. In the acceptation of poultry welfare issues it is, therefore, important to incorporate both female and male points of view. In the LayWel project gender is integrated into the project through the balance of female scientists involved. At the start of the project about 50 % of the researchers is female.

Appendix A - Consortium description

A.1 Participants and consortium

Role of the participants

The partners of the consortium cover much of the research that is going on in Europe in the field of housing and welfare of laying hens. In their own country they are well known and respected and they have close connections to both government and industry. Partners also have a worldwide reputation, are seen as major experts in their field of research and are frequently invited for presentations all over the world. The combination of these partners will ensure the wide acceptance of the final report.
The Workpackage leaders are chosen for several reasons: they have many years experience with housing and welfare of laying hens, they have extensive international experience and they have proven to be reliable participants in international projects. Many of them have had leading roles in previous European projects.

SME involvement

In order to obtain reliable estimations on the impact of variable conditions that may exist in the different situation in the Member States, SMEs (producers and qualified NGOs) from a wide range of different Member States cooperate within in it. As all partners have research projects running in the field of welfare and housing of laying hens, contacts with several private companies are frequent and in most cases consolidated in local projects. Results of these local projects will be incorporated in the LayWel report. Information on housing systems will be collected in various countries with the help of local and internationally orientated private companies. As the partners of the LayWel project are leading in the field of welfare and housing of laying hens, private companies are seeking the co-operation in a form where they provide information and materials and researchers provide knowledge. This mutual interest ensures the input from private companies without the necessity to allocate separate budgets.
The choice of partners in the LayWel project ensure the co-operation of all leading cage manufacturers and most of the leading manufacturers of other housing systems for laying hens. Also involvement of other private companies is ensured: breeding companies (ID-Lelystad, DIAS, INRA, SLU, UHOH have close contacts with breeding companies), feed companies (all partners have contacts with several local feed companies), producers (all partners have close contacts with several large producers).
In addition, partners also have close contacts with National Egg Boards (several partners get part of their research funding from these organisations) and national animal welfare organisations.

Resources and specific skills

Partner 1, Institute for Animal Science and Health (ID-Lelystad), Lelystad, The Netherlands

The Institute for Animal Science and Health (ID-Lelystad) conducts veterinary, zootechnical and biomedical research. With its research, its advisory services and high quality veterinary vaccines and diagnostic tests, ID-Lelystad carries out fundamental and applied research in the fields of animal production, welfare and health. Important research priorities are: quality of animal production in order to create good welfare conditions for the animals and safe, acceptable and durable products.

Dr. H. Blokhuis, will act as overall project coordinator. He has more than 20 years experience in animal welfare research. He has published extensively in scientific journals and contributed to many scientific congresses. An extensive part of his work was related to laying hen behaviour, housing and welfare. Dr Blokhuis has a long standing experience in leading complex multidisciplinary research programmes. For many years Dr Blokhuis was programme leader of research programmes for the Dutch Ministry of Agriculture, Nature Management and Fisheries. These programmes involved the study of housing, stress and animal welfare in cows, pigs and poultry. He also coordinated two EU funded international research programmes, one on veal calves and one on laying hens. At present Dr Blokhuis is chairing an action in the framework of COST (European co-operation in the field of scientific and technical research). The Action (no. 846) is called “Measuring and monitoring farm animal welfare”.

Untill recently he was leading the research group "Animal Welfare" at ID-Lelystad. At present he is consultant for International Research Networks and linked to the Animal Sciences Group of Wageningen University and Research Centre.
Dr Blokhuis is member of the Scientific Committee for Animal Health and Animal Welfare, an advisory body to the European Commission. Dr Blokhuis is Dutch representative in Technical Committee of COST in the domain Agriculture, Food Science and Biotechnology. He is also member of the Scientific Steering Committee of the Belgian Policy Research Centre for Sustainable Agriculture.
Dr Blokhuis is a member of the World's Poultry Science Association and the WPSA working group on Poultry Welfare. He is member of the International Society for Applied Ethology and serves as Regional Secretary for the Benelux. He is a member of the American Society of Animal Science. He is member of the Dutch Zoötechnical Society and EAAP contact person in the Netherlands for the Management and Health Commission. He is member of the Editorial Advisory Board of Applied Animal Behaviour Science and of the International Editorial Board of Veterinary Sciences Tomorrow.

Dr I. de Jong is a scientific researcher poultry welfare at the Animal Welfare Group. She has 6 years experience in stress physiology and applied ethology. In 2001 she received her PhD in Animal Physiology on behavioural and physiological research in pigs. Since 2000 she is working as a project leader in several poultry projects, e.g. in a project on feather pecking in laying hens and currently in a project concerning behavioural priorities in laying hens. She will be working on WP4.

Partner 2: Research Institute for Animal Husbandry (PV-Lelystad), Lelystad, The Netherlands

The Research Institute for Animal Husbandry (PV-Lelystad) is a merger between three well known institutes for Applied Research on 1. cattle, sheep and horses, 2. pigs; 3. poultry, rabbits and minks. The new organization continues to conduct research that is closely linked to commercial situations, but due to the merging the work can be done more efficient and more know-how will be available. At this moment PV-Lelystad has 7 local and 3 central research stations. About 220 people are employed. PV-Lelystad is part of Wageningen University and Research Center, in which other research institutes take part. PV-Lelystad works close together with ID-Lelystad and Wageningen University. Research is focussing on all aspects of farm animal husbandry.
PV-Lelystad is working on alternative housing systems for laying hens for more than 25 years. As since 1993 research on enriched cages is conducted, PV-Lelystad is one of the most experienced institutes in this type of housing. Apart from this, research is conducted on aviaries, free range, deep litter and the possibilities to omit or reduce beak treatments.

Ir. T. Fiks - van Niekerk is senior research leader and already involved in research with laying hens since 1989. Main areas of interest are welfare and housing of laying hens. She was involved in the first introductions of aviary systems on commercial farms in the Netherlands. Since the start in 1993 she is project leader of the research on enriched cages. She is member of the World's Poultry Science Association and the WPSA working group on Poultry Welfare. She has participated in earlier European projects concerning welfare implications of bone weakness of laying hens. She will participate in the co-ordination team. She will use her wide experience in research in experimental units and on commercial farms with many different housing systems for laying hens, to lead WP2.

Partner 3: ADAS Gleadthorpe Poultry Research Centre (ADAS), Gleadthorpe, United Kingdom

ADAS offers an independent and comprehensive range of business and technical services, delivered through multi-skilled teams to match the individual requirements of their customers. ADAS carries out a wide range of R & D projects for national and international clients.
ADAS Gleadthorpe has poultry research facilities for approximately 30,000 birds. Their poultry research portfolio covers a diversity of subject areas, from nutrition and welfare to environmental impact and new product appraisal. The Poultry Research Team currently comprises 15 people.
ADAS has wide experience of applied poultry systems research and in particular has carried out the largest scale research on enriched cages in the UK over the last few years. ADAS also has considerable experience of multi-partner research.

Mr. H.A. Elson is international poultry systems specialist with expertise in all aspects of poultry systems, equipment and bird welfare. He is an acknowledged world expert in laying cages (both unenriched and enriched), alternative egg production systems and broiler feeder and drinker design. He acts as project consultant for ADAS and provide specialist advice on housing systems and EC legislation. He will co-ordinate data and information between ADAS and other partners in the LayWel project.
With his close contacts with both research and commercial farms with alternative housing systems for laying hens (including enriched cages), both in the UK and abroad, he will be WP-leader of WP6.

Mr. A. Walker is programme manager of the pig and poultry research, under which the research on enriched cages in the UK. His specialism is poultry nutrition, welfare and environment research. He has knowledge of systems-based research particularly involving production/welfare interaction studies. He will oversee ADAS involvement in the LayWel project and will carry out quality checking on data and written documents.

Partner 4: Danish Institute of Agricultural Science (DIAS), Foulum, Denmark

The Danish Institute of Agricultural Sciences (DIAS) is a sector research institution under the Ministry of Food, Agriculture and Fisheries. DIAS was established on April 1, 1997 with the merging of the Danish Institute of Animal Science and the Danish Institute of Plant and Soil Science. With its approximately 1,125 employees DIAS is one of the largest research institutions in Denmark.
The Department of Animal Breeding and Genetics has about 60 employees of which 35 are classed as scientists. Focus is on genetically improvement of animals for disease resistance, constitution, and behaviour. Modern animal husbandry is based on advanced theoretical breeding methods and principles, and increasingly relies on research in biometry, gene technology and reproductive biology. The department also leads the national effort to preserve genetic resources in Danish farm animals.
DIAS has a long experience in research on behaviour and behavioural problems of laying hens. At the Institute, lines of laying hens have been developed differing in the level of feather pecking (Kjaer et al., 2001). These lines are unique in the world, and they will provide birds for the experiment on litter preferences (WP4) and genetic differences in stress physiology (WP5). With regard to genetic analyses, the Institute will provide world-renowned experts in the field of data analyses using animal models and computer programs for estimating genetic parameters.

Dr. J. Kjær is employed at DIAS since 1990, now holding a position as a senior research scientist, Department of Animal Health and Welfare, Danish Institute of Agricultural Sciences.
Areas of research are mainly connected to welfare in poultry and game birds. The behaviour, health and physiology of different laying strains in egg production systems alternative to battery cages has been a key issue. The abnormal behaviours of feather pecking and cannibalism are causing attention. Genetic studies on feather pecking has been conducted since 1993 resulting in divergent selection lines differing in level of feather pecking. Studies on neuroendocrinology in relation to feather pecking have been conducted since 1997. He will be responsible for the DIAS participation in the project. With his wide experience in poultry behaviour, he will be WP-leader of WP4.

Prof.Dr. P. Sørensen is employed at DIAS since 1973 and now holding a position as Deputy Head of Departent at Department of Animal Breeding and Genetics.
Fields of work include: Selection- and breeding experiment with poultry, scientific investigation on genetic adaptation of poultry to new management systems, genetic aspect of leg disorders in broiler chickens, poultry research in Developing countries, teaching Poultry breeding and genetics at M. Sc. courses at the Royal Veterinary and Agricultural University, Copenhagen, co-ordination of research in poultry at DIAS, and support the Head of department in administration and managing the department.
He will participate in WP4 and WP5 of the LayWel project with special focus on the estimation of genetic parameters.

Partner 5: Institut National de la Recherche Agronomique - Nouzilly (INRA), France

The Institut National de la Recherche Agronomique (INRA) was set up in 1946 and became a national public scientific and technological establishment in 1984, under the joint authority of the Ministries of Research and Agriculture. The INRA institute is subdivided in 17 Research Department among which the Animal Husbandry and Nutrition Department (Département Elevage et Nutrition des Animaux: ENA). One

of the seven research units of the ENA Department is the Poultry Research Unit (Station de Recherches Avicoles) which associated with an experimental unit (Poultry Experimental Farm). This unit has 120 employees in its laboratories and experimental farm: 42 research scientists, 63 technicians and administrative staff and 15 graduate and post-graduate students. It conducts integrated research on the biology of birds, from molecular biology studies to studies of the animal in its environment involving different disciplines (genetics, nutrition, behavioural biology, reproductive physiology and growth) and several species (chicken [broiler and layers, turkey, duck, guinea fowl, quail and pheasant). This research aims at anticipating the demands of both consumers and producers, and the resulting knowledge will allow improvements to be made in poultry products and rearing techniques. Thus, by exploiting experimental lines and comparing farming methods, the unit develops and evaluates innovative systems, which improve product quality and animal welfare.

Dr. D. Guémené first joined the Poultry Research Station of the National Institute of Agronomic Research in 1983, where he is currently serving as a senior research scientist. In 1984, Dr. Guémené held a one-year position with the National Agency for the Valorisation of Research (ANVAR Bretagne) and spent a two-year leave working in the laboratory of Dr. Etches in the University of Guelph (Canada). Dr. Guémené's research interest have included studies of the physiology of domestic birds with specific emphasis on the endocrinological regulation of the expression of incubation behaviour in various species (turkey hens, domestic hens, pheasant hens, geese) and more recently on domestic bird welfare (mule ducks, geese, laying hens). His work in those fields has been published in over 200 refereed scientific papers, technical papers or various communications in meetings. As an expert for both the producers and the French delegation, he has also participated to the discussions for the elaboration of recommendations regarding duck, geese and turkey productions at the European Council. He is presently in charge of the "Behavioural Biology and Adaptation in Domestic Birds" research team at the Poultry Research Unit and assistant to the Head Chief Research Department. With his wide experience in physiology and stress measurements, he will be WP-leader of WP5.

Partner 6: Swedish University of Agricultural Science (SLU), Funbo-Lövsta,Uppsala, Sweden

The Avian Division of the Dept. of Animal Nutrition and Management, employing about 100 people, belongs to the Swedish University of Agricultural Sciences (SLU), Uppsala. The Division moved into the Research Centre of Funbo-Lövsta in 1973 together with the Division for Pigs and Poultry at the Dept. of Animal Genetics. The administration and Head Office of these two departments are located at the University Campus.
The Avian Division at Funbo-Lövsta, including 11 people, has long experience of collaboration with the industry both on national and international basis as regards the planning and running of studies on environmental effects on layers from housing systems and designs. It is one of the main Centres in Europe on these topics. The studies have been focused on effects on production, health and applied behaviour with the aim to improve unenriched cages, floor systems as well as enriched cages. Collaboration with other groups in Europe has also produced joint scientific papers in international journals. During the recent years the Department has been responsible for follow up of production and health data from commercial farms with different equipment when testing them, e.g. aviaries and enriched cages. This material can provide in a unique way to the evaluation of different systems in commercial use. Contacts with the authorities of either veterinary or other categories have been extensive.

Assoc. Prof. R. Tauson is a specialist on research in housing systems and their effects on production and behaviour of laying hens since 1974. He has extensive experience with all housing systems for laying hens and with enriched cages in particular. He is in charge of the research on housing systems at Funbo-Lövsta. He is advisor of the Swedish government in issues dealing with welfare and housing of laying hens. He has developed a scoring system for poultry integument (feather cover, foot pad lesions, injuries, etc.) that is used in Sweden to evaluate housing systems in commercial use. The system is also used in Denmark, Finland, Germany, Spain and outside the EU in Australia, Canada and Norway. He is a member of WPSA Working Group on Poultry Welfare and was chairman of this group between 1986-1995 and has participated in several European Projects dealing with laying hens. With his wide experience in evaluating health parameters, he is WP-leader of WP3.

Partner 7: University of Bristol (UNIVBRIS), United Kingdom

The University of Bristol (UNIVBRIS) is a world-class university offering a stimulating academic environment with centres of excellence in all faculties. In the 2001 national Research Assessment Exercise (RAE), Bristol demonstrated its position as one of the UK's leading research universities.
The Department of Clinical Veterinary Science employs over 100 academic/professional members of staff and 130 support staff in the Department, organised into three divisions. The Department is contributing both to fundamental bioscience and to veterinary science.
In the last RAE Animal Behaviour and Welfare was identified as a particularly strong group within the Department. This group is led by Professor C. Nicol, and comprises 21 academic staff, 5 support staff, and 8 post-graduate students, making it the largest research group in this area in the UK. The strength of this group is that within the single department a cross-disciplinary approach can be applied to answer major fundamental and applied questions. The group has a strong internationally-recognised track record in fundamental studies of animal welfare, including methods of measuring motivation, the causation of abnormal behaviour, social interactions, animal cognition, pain and pain relief. It is also strong in applied aspects of animal welfare, particularly studies of poultry housing and husbandry, lameness, transport, slaughter, the on-farm assessment of welfare and the application of epidemiology to on-farm welfare problems.

Prof. C. Nicol graduated from Oxford University in 1981 with a first class honours degree in Zoology. She then completed a PhD on the welfare of caged laying hens, which was awarded in 1986. In the same year she moved to a lectureship in farm animal welfare at the University of Bristol, where she proceeded to develop a research group. She has published over 200 articles, including 87 papers in peer reviewed journals, and has attracted the equivalent of more than 4 million Euros in research funding. She promoted to a Personal Chair in 2001 and continues to lead a large and successful research group. As she has a wide experience in both fundamental and applied questions related to welfare issues, she is WP-leader of WP7.

Partner 8: University of Hohenheim (UHOH), Stuttgart, Germany

As part of the University of Hohenheim, the Institute of Animal Husbandry and Breeding has three full Professors, 9 scientists on post-doctoral level. The technical and clerical staff comprises about 20 persons. The institute has access to two animal research stations with research facilities with dairy cows, pigs and poultry. The section "Farm animal Ethology and Small Animal Sciences" has been working on welfare problems in laying hens continuously for more than 30 years. The main fields of research were behaviour and productivity of laying hens under different housing conditions, poultry nutrition and breeding. With regard to welfare the locomotion activity, dust bathing, feather pecking and cannibalism have been studied.
Comparisons of the productivity traits in enriched cages and unenriched cages have been started at the University of Hohenheim in the year 1999. Particular behavioural problems related to feeder space and utilization of perches are being investigated in current experiments. The section Farm Animal Ethology and Small Animal Sciences has established relationships with private farms keeping hens in enriched cages and other production systems.

Prof. W. Bessei is full professor at the Institute and head of the section Farm Animal Ethology and Small Animal Sciences. He has more than 30 years experience in research on poultry behaviour and welfare. He was member of various Expert groups on poultry welfare , on the national and international level, e.g. the EU on the welfare of laying hens and broilers, the German Federal Ministry of Agriculture on layers, broilers, turkeys and waterfowl. His main field of research is the interface of genetics and housing systems with regard to the behaviour of poultry. Prof. Bessei is member of the World's Poultry Science Association (WPSA), the American Poultry Science Association and the German Association of Animal Breeding. As member of WPSA working group on poultry Welfare he has been actively involved in the preparation of the Symposia on Poultry Welfare. As internationally renowned scientist he has been invited to present papers at international congresses. He is member of the Editorial Boards of the World´s Poultry Science Journal, the Archiv für Geflügelkunde and Anomal Science Papers and Reports.
With his extensive experience in poultry welfare issues, he will be WP-leader of WP1.

Prof. Dr. M. Grashorn is senior scientist of the Institute of Animal Husbandry and Breeding and head of the working group for egg and poultry meat quality. He has more than 15 years experience in research on egg quality. His main field of research is the influence of housing and feeding on egg quality. During the last

years he has focussed his activities on the effect of housing systems on egg quality, on enrichment of eggs with Omega-3-Fatty Acids and on the use of natural carotinoids for pigmenting the egg yolk. He is member of the WPSA, member of the Working Group IV (Egg Quality), chairman of Working Group V (Meat Quality) of the European Federation of WPSA and Editor in Chief of the Archiv für Geflügelkunde. On the basis of his specialised knowledge he was invited to participate in the EU Expert Group on Egg Yolk Pigmentation. He is frequently invited to national and international congresses. He will provide inputs to WP6.

Dr. A. Harlander-Matauschek is Junior Scientist at the Institute of Animal Husbandry and Breeding. She has been working on the behaviour of laying hens in loose house systems and in free range systems. At present she works on factors influencing feather pecking and cannibalism. She will provide inputs to WP3 and WP7.

Partner 9: University of Zaragoza (UNIZAR), Zaragoza, Spain

The University of Zaragoza (Universidad de Zaragoza) was founded in the year 1462 and the Faculty of Veterinary Medicine (Facultad de Veterinaria) is 152 years old. The areas of research are animal production in all its aspects (systems, nutrition, reproduction, breeding, food technology & inspection). At the Department of Animal Production and Food Technology (Producción Animal y Ciencia de los Alimentos) 131 people are employed, whereof 71 scientists. The department is focussing on sheep, cattle, pigs, rabbits and poultry. The Animal Welfare Group of the Animal Production & Food Science Department of UNIZAR is the only group in Spain working with alternative housing systems for laying hens at commercial scale in an experimental unit property of the University of Zaragoza (equipped with funds coming from the national government, small & medium enterprises related with the egg production sector and the Spanish egg producers association). The experiments carried out in this poultry unit have the objective to test current commercial enriched cages under Spanish production conditions (hot climate, high natural light) and to develop - with the cooperation of a local poultry equipment company - a commercial enriched cage. This cage is already developed and UNIZAR is improving the original design. UNIZAR is also reference testing institute for a German poultry equipment company and this company uses information from the Spanish projects to improve the commercial designs. The tests include productive indexes, egg quality traits, behavioural needs, behaviour abnormalities, health indexes, stress indicators, plumage conditions, foot conditions etc.
UNIZAR has a strong relation with the egg producers sector, the retailers and consumers associations and the manufacturers of poultry equipment. This relation give them the opportunity to interact with the "real" problems of the welfare issues and its impact on the production systems. Their goal is to give solutions to these problems. All these things make UNIZAR "unique" in Spain and makes them the proper partner for the LayWel project.

Prof.Dr. G. Maria Levrino is a Professor of Animal Science at the University of Zaragoza. He is leading a national project to develop a model of enriched cages in Spain, funded by the Spanish association of Egg Producers, the Spanish Industry of Poultry Equipment and the Ministry of Science & Technology of Spain. The Spanish model of enriched cage is under test in the Poultry Unit of the Faculty of Veterinary Medicine of Zaragoza. He is the Spanish coordinator of a European Project CATRA on the Effect of transport on Animal Welfare and Meat Quality on Cattle. He is the Spanish Representative in WPSA Working Group on Poultry Welfare.

Prof.Dr. R. Cepero Briz is a Professor of Poultry Science at the University of Zaragoza. He is the coordinator of several national projects in co-operation with Poultry Equipment Industry. The projects are mainly related with the alternative housing systems in laying hens, with special emphasis on the effect of alternative housing systems on the egg quality. He is the Director of the Poultry Experimental Unit in the University of Zaragoza. He is also the President of the Spanish Branch of the WPSA.

A.2 Sub-contracting

There are two subcontractors involved:
INRA: INRA has a close relation with other institutes in France and Norway. This longlasting co-operation has lead to a specialisation in lab work. This means that ELISA for measurements of specific

Antibodies, and H/L ratio will be determined by the subcontractors AFSSA and Norway. INRA is running corticosterone assays for them, but this is not completely compensating the cost for the ELISA and H/L measurements. Also data from the Norwegian institute will be used. As there is frequent exchange of data, also for other projects, this is the most efficient way to get the lab measures are done.

UNIVBRIS: The subcontractor of UNIVBRIS will provide additional data from Bristol to WP5. The data come from a project, where a Dutch researcher (Dr. P. Zimmerman) is working on. This researcher will get back to the Netherlands in March of April 2004. The subcontracting formula is chosen to make sure the researcher will make the data available for the LayWel project on a freelance basis, whatever his situation and wherever he is. The advantage of this approach is that the work can be done in a minimum of time, and thus money, as the researcher knows all the ins and outs of the project. No other researcher has the same knowledge and could do the task that efficient.

A.3 Third parties

Substantial input will be given by SME's. Their input will be secured by national projects in which they have engaged themselves. Most of them are poultry equipment manufacturers, but also feed companies, breeding companies etc. are involved.
Per country the following partners are of major importance because of financial contributions or supply of materials and/or housing systems.

Netherlands:
- Janssen Poultry Equipement
- Big Dutchman International GmbH (Mr. J. Blomendahl)
- Lohmann Tierzucht (Ir. H. van Faassen, Prof. Dr. R. Preisinger)
- Due to past projects close contacts with many poultry equipment manufacturers (Meller Poultry Services, Hellmann Poultry GmbH & AG, Ten Elson - Specht, Vencomatic b.v., Farmer Automatic b.v.)

Sweden:
- Bröderna Victorsson AB (Mr. Hakan victorsson)
- Big Dutchman International GmbH (Mr. J. Blomendahl)
- Hellmann Poultry GmbH & AG (Marcellus Hellmann)
- Triotec OY (Esko Katteluus)

Germany:
- Deutsche Frühstücksei
- Big Dutchman International GmbH (Mr. J. Blomendahl)
- Salmet Deutschland (Mr. Gregor Zimmerer)
- Lohmann Tierzucht (Prof. Dr. R. Preisinger)

DK:
- Hellevad Rugeriet (Mr. Wulff), Breeding company
- Lohmann Tierzucht (M. Schmutz and Prof. Dr. R. Preisinger).
- Landmeco A/S (Mr. S. Andersen)

E:
- Zucami Poultry Equipment
- Big Dutchman Ibérica, S.A.
- Nanta S.A. (Nutreco Group) 1st Spanish supplier of layer feeds
- Roche Vitamins
- Ibertec S.A. (1st supplier of replacement pullets)
- Avigan Terralta S.A. (2nd íd)
- Center for Poultry Health, Cataluña & Aragon (CESAC)

UK:

- Deans Food Ltd (Andrew Joret)
- Patchett Engineering Ltd. MD (Paul Patchett)
- Big Dutchman International GmbH (Ulf Meyer)
- Isa Poultry Ltd (Mike White)
- Valli International srl. (Marcello Valli)
- Vencomatic bv. (Paul Turley)
- Solutia Europe (Jan Mertens)
- Kovobel v.d. (Emil Beber), Czech Republic - the main cage & poultry equipment manufacturer

F:
- ITAVI (Avian Technical Institute),
- SYNALAF (National Union for French Avian Label Products), Including free range and organic producers
- SYSAAF (National Union for French Avian Breeders), Including laying hens (ISA)

A.4 Other countries

No funding is requested for third country participants.

Appendix B - References

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