

**Evaluation report 2009**

# Evaluation of SLF-funded Research 2002–2007



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# Preface

In order to reduce an excessive use of commercial fertilizers and pesticides and a subsequent negative environmental impact, Swedish farmers pay a tax on these commodities. Since 2002, part of the tax has been redistributed to the Swedish Farmers' Foundation for Agricultural Research (SLF). The aim is to use these funds to finance applied research in support of the development of sustainable practices in agriculture and horticulture. The redistributed taxes comprise nearly half of the research funding by SLF and also a significant part of the total Swedish funding of applied research within the area.

Last year Formas was commissioned by the Swedish government to evaluate the tax-funded research of SLF during 2002–2007. Formas interpreted the mandate as to assess the scientific quality, relevance and impact of the funded research. The task also covered the funding management procedures of SLF and the fulfilment of the general governmental intentions regarding the redistribution.

The evaluation comprised nearly 250 projects. Formas assigned a large number of external reviewers for the assessment of individual projects and a Nordic panel for formulating the overall conclusions and recommendations. The panel was skilfully led by Research Director Professor Mari Walls from MTT Agrifood Research, Finland. Formas fully acknowledges the crucial contribution of the panel and especially of its chair.

The panel concluded the evident strengths and weaknesses of the research performance and of the funding procedures. A major strength was the significant practical relevance of the research. A major weakness was an overall fragmentation of topics and a surprisingly low research output, both in regard to scientific articles and to stakeholder communication activities.

The panel provided several recommendations aimed at improving management of the research funding. It was



*Rolf Annerberg  
General Director  
Formas*

recommended for example that SLF should fund fewer but larger projects, pay more attention to scientific quality in the proposal selection procedure, encourage interdisciplinary research and international collaboration, and request and secure more deliverables from the funded projects. The panel finally identified some important and emerging research lines for future funding.

Formas is convinced that SLF and all stakeholders will seriously consider the results of the evaluation. Thus, it will decisively contribute to the improvement of research funding and performance and the long-term transition of Swedish agriculture and horticulture in a sustainable direction.

*Rolf Annerberg*

General Director, Formas

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# Summary

The Government of Sweden the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, (Formas) a commission to evaluate the research that has been funded via the redistribution of taxes on commercial fertilizers and pesticides to the Swedish Farmers' Foundation for Agricultural Research (SLF) and the Foundation for the Development of Agriculture (SLUT) during the period 2002–2007. Formas has interpreted the commission as a targeted assessment of whether the redistributed taxes for research funding have been used in an appropriate way in accordance with the governmental intentions and whether there are means for further improvements in the quality, relevance and efficiency of this research funding in the future. The aims regarding the use of the funds, as expressed by the decisions of the Swedish Board of Agriculture, relate in general to sustainable development in agriculture, including reducing environmental impact.

A Nordic Panel was appointed by Formas in October 2008 to carry out a final evaluation with the scientific quality and the relevance of research for sustainable agriculture and related economical activities in Sweden as a focus. The SLF process in managing the funding was also a focus of the evaluation.

The evaluation procedure consisted of two phases. The first phase of the evaluation process took place during September–October 2008 when each individual project was primarily evaluated by two independent external reviewers – in most cases one scientist and one relevance person (practitioner) – based on the project reports and reprints provided by Formas. The Nordic Panel was assigned to identify the strengths and weaknesses of key thematic areas as well as of the programme in general. The Panel was to make recommendations for the future to strengthen the research and the SLF procedures for managing the research funding. The Panel's assessment work was organised in four thematic working groups comprising the following themes: Agriculture and horticulture, Plant nutrient turnover and pesticides, Animal production, Economy and market, and Working environment.

At the level of evaluating the thematic areas, the Panel structured the work according to the following questions regarding scientific quality: scientific rationale, methods used, quality and merits of the project leader, scientific and practical outputs, cooperation and training. Regarding societal relevance and gain, the following questions were investigated: importance of research for Swedish and Nordic agriculture, linkages to sustainable development dimensions, generation of new and important knowledge, and communication of research results. In addition to the thematic level approach, the Panel evaluated the strengths, weaknesses and opportunities of the SLF funding in general and future recommendations. Furthermore, the Panel also evaluated the SLF programmatic approach, funding procedures and process-related issues and made general recommendations on these.

The total SLF funding being subjected to this evaluation was 208 MSEK for the years 2002–2007. With external co-funding the total funding volume was 267 MSEK. The total number of reported projects was 248.

In general, there was very large heterogeneity in the orientation and performance of projects within a given thematic area with regards the sustainability objective of the funding. However, the project portfolio revealed some clear strengths, as well as some weaknesses, common to all thematic areas evaluated.

The strengths included the high relevance of research, and in general, the topics seemed to be well warranted and need-driven. Most of the projects were of an applied nature and had a strong link to practical problems. Some projects had developed excellent and efficient communication practices, which could serve as best practices for other projects.

The weaknesses of the project portfolio included an overall fragmentation of the research and available resources into many small projects, which severely hinders the impact of the research. The Panel identified a general lack of interdisciplinary approaches that could be profound in providing solutions for sustainability in agriculture. Too many projects did not deliver sufficient outputs. This was evident when evaluating the number of scientific peer reviewed articles, international and national research collaborations and communication, and various aspects of popular communication. The average number of peer reviewed publications was

only 0.3 articles/project and the average number of popular publications was only 0.4 publications/project. Furthermore, the projects showed relatively low performance related to communication and dissemination of results, with less than one half of the projects showing activities. This is in contradiction to SLF specific goal setting regarding the importance of communication. The projects also showed a low level of international partnerships: the proportion of projects with international cooperation was only 29.4 per cent.

Key SLF program recommendations and process related issues include the need to formulate SLF calls for proposals in a way that would stimulate interdisciplinary work and international links. All proposal call texts should also be provided in English as this may encourage more international collaboration. SLF should further develop the format for the submission of research project proposals and the selection procedure to ensure both high scientific quality and relevance. During the SLF selection procedure, a clear distinction should be made between evaluating scientific quality and relevance. Researchers should evaluate and ensure a high scientific standard and the beneficiaries/ end-users should evaluate the relevance of the proposals. The Panel recommends that SLF should preferably have only one selection/ grant awarding committee that should also be much more homogenous in respect of representation of researcher and stakeholder representatives. It is also advised that SLF could use international scientific experts in the evaluation process. Developing new national and international co-financing schemes for interdisciplinary research areas should be prioritised.

Regarding future challenges, the Panel recognised that Swedish research can be leading in the area of agriculture and sustainability if current strengths are clearly identified, strategic choices in developing attractive funding schemes are made by different financiers, and emerging key research lines are supported accordingly. There is clearly a need for closer interaction between end-users and researchers, not only to strengthen the knowledge transfer to the agriculture sector but also to facilitate a two-way dialogue that can bring up and formulate new questions and develop new research directions. SLF's position to enhance that dialogue with a wide network in the sector is unique. Linking different disciplines and different research institutions to join their capacities for sustainable agriculture and management of natural

resources can be very fruitful. Agricultural production and sustainability will go hand in hand if the results can be transformed into new solutions and changed behaviour.

The Panel identified some emerging lines of research of importance for Swedish agriculture in the future based on the project portfolio under evaluation. Promising issues for future research include adaptation of agricultural production to changing climate and environments, sustainability and welfare issues in animal production, research in the area of ecosystem services linking biology to technology and economy in a sustainable production context, and linking new ICT technologies to production and processing as well as to risk management and traceability in the whole food chain. These are research areas that would also allow new lines of business development and public-private partnerships. All of the above mentioned research fields also call for interdisciplinary approaches.

In view of the policy of the Swedish Government to encourage sustainable development in agriculture and to decrease environmental impacts related to agricultural production, the Panel recommends that SLF should focus on supporting high quality interdisciplinary projects aimed at solving the challenges of sustainable production. Possibilities for new co-funding schemes with other financing agencies should be considered. A broader funding base would allow sufficient financing for research topics of high relevance. The societal impact of research could be improved by seeking efficient ways to disseminate research results to the scientific community, end users and the general public, by establishing active national and international collaboration and by targeting the training of students and next generation scientists.

As the main conclusions of the evaluation of the SLF-funded research, the Panel recommends:

1. That larger but fewer projects are funded to avoid fragmentation of the funding into relatively low-impact small projects.
2. That SLF should be active in developing new national and international co-financing schemes for interdisciplinary research areas.
3. That more emphasis is put on the generation of deliverables in the form of scientific, peer reviewed papers.

4. That detailed dissemination and communication plans with milestones should always be included as part of a project proposal.
5. That the researchers are encouraged to actively liaise with local extension service officials and other key beneficiaries and end-users of research, starting already in the early planning stages of the project.
6. That SLF further develops the format for the submission of research projects and fully adopts the practice that the calls for proposals are streamlined and coordinated for one call each year. The proposal calls should be formulated in such a way as to stimulate more interdisciplinary work and focus on wider national and international collaboration.
7. That all call for proposal texts are also provided in English, as this may encourage more international collaboration. Submission should also be allowed in English.
8. That the current selection procedure is improved so that there are clear criteria for evaluating 1) firstly research quality and 2) secondly the relevance of projects. Researchers should evaluate and ensure a high scientific standard and the beneficiaries/ end-users should evaluate the relevance of the proposals.
9. That there would be preferably only one SLF selection/ grant awarding committee that would also be much more homogenous in respect of representation of researcher and stakeholder representatives. It is also advised that SLF could use international scientific experts for the evaluation process.
10. That information on final reports and other project publications should be announced on SLF homepages. An English summary of the final report should also be provided.



# Introduction

The Government of Sweden has given Formas a commission to evaluate the research that has been funded via the redistribution of taxes on commercial fertilizers and pesticides to SLF and SLUT during the period 2002–2007.

## **Mandate of the panel**

Formas has interpreted the commission as a targeted assessment of whether the redistributed taxes for research funding have been used in an appropriate way in accordance with the governmental intentions and whether there are means for further improvements in the quality, relevance and efficiency of this research funding in the future. Formas expects the outcome of the evaluation to benefit Swedish agriculture, government, SLF, SLUT, and affiliated researchers at universities, other institutes and companies.

The redistribution of taxes on commercial fertilizers and pesticides to SLF and SLUT to support applied research and development has taken place since year 2002. The amount of reinvested taxes has varied a lot during the period under study. During the first year, 2002, the amount was 15 MSEK. In 2008, the amount had increased to more than 80 MSEK. The aims regarding the use of the funds, as expressed by the decisions of the Swedish Board of Agriculture, have varied over time, but a contribution to a sustainable development of agriculture, including reduced environmental impact, has generally been put forward.

An evaluation concerning the use of the redistributed tax funds for applied agricultural research and development has not been previously undertaken.

## **Scope of the evaluation**

The evaluation should focus on the scientific quality and the relevance of research for sustainable agriculture and related economical activities in Sweden. The evaluation should also focus on the SLF process in managing the funding.

## Composition of the panel

The Panel was appointed by Formas in October 2008. The Panel consisted of experts from different disciplines in agriculture and natural resources management as well as relevance members (practitioners) having a profound experience related to Swedish agriculture. Panel members were invited from four Nordic countries.

The Panel members and their respective affiliations were:  
*Magnus Börjesson*, Chairman, AgroÖst R&D and CEO, Högåsa Gård AB, Sweden

*Brita Dahl Jensen*, Associate Professor, Department of Agriculture and Ecology, Faculty of Life Sciences, University of Copenhagen, Denmark

*Per Jonsson*, Senior County Veterinary Officer, Assoc. Professor, County Administrative Board of Södermanland, Sweden

*Erik Steen Kristensen*, Professor, Head of Department, Faculty of Agricultural Science, Aarhus University, Denmark

*Tore Krogstad*, Professor, Department of plant and environmental sciences, Norwegian University of Life Science (UMB), Ås, Norway

*Ilkka P Laurila*, Development Director, MTT Agrifood Research, Finland

*Torleiv Løken*, Professor, Norwegian School of Veterinary Science, Norway

*Sara Bergström Nilsson*, Extension Officer, Växa, Sweden

*Grete Lene Serikstad*, Advisor, Organic Food and Farming Division, Norwegian Institute for Agricultural and Environmental Research, Norway

*Jan Tind Sørensen*, Professor, Head of Research Unit, Department of Animal Health, Welfare and Nutrition, Faculty of Agricultural Sciences, Aarhus University, Denmark

*Mari Walls* (Chair), Research Director, Professor, MTT Agrifood Research, Finland



## Evaluation procedure

The total number of funded projects during the years 2002–2007 was approximately 360 according to a list provided by SLF. In June 2008 all principal investigators were asked to submit a special report, as outlined by Formas, together with available reprints. Such a report was provided for nearly 70 per cent (248) of the projects. These projects were then subjected to the evaluation described below. Half of the projects were still ongoing (final year after the year 2007). The project reports were distributed into 12 main thematic fields (Table 1).

Table 1. Distribution of reported projects over thematic main-fields

Main Field	Percent %
Crops and plants – agriculture	24.0
Dissemination/extension/education	0.8
Domestic animals	18.0
Economy and market	5.7
Engineering – mostly buildings	4.5
Environment – other	3.7
Horticulture	16.0
Pesticides	5.7
Plant nutrient turnover	14.0
Social aspects	0.4
Soil – physics/tillage/drainage	2.0
Working environment	5.7
<b>Total</b>	<b>100.0</b>

The first phase of the evaluation process took place during September–October 2008. Each individual project was primarily evaluated by two independent external reviewers – in most cases one scientist and one relevance person (practitioner) – based on the project reports and reprints provided by Formas. Each reviewer evaluated several projects (on average 5) to gain a perspective on the nature and quality of the projects funded in his/her thematic area. The individual reviewer's evaluation statements were written in a fixed form provided by Formas and utilised a set of criteria for scoring the individual project.

Each individual project was assessed for both scientific quality and relevance with a grading scale of 0–5, as follows:

0 = judgement not possible

1 = very deficient project

2 = somewhat deficient project

- 3 = sufficiently good project
- 4 = very good project
- 5 = excellent project

The scientific quality assessment included assessments of:

- (a) scientific rationale,
- (b) scientific methods,
- (c) competence of the Principal Investigator,
- (d) scientific article output,
- (e) visibility at international conferences,
- (f) national and international cooperation, and
- (g) the contribution to competence building among students/young scientists

The relevance and benefits assessment included assessing the following:

- (a) importance of research for Swedish and Nordic agriculture,
- (b) importance for sustainability issues,
- (c) usability of the results, and
- (d) communication activities.

In October 2008, Formas appointed a Nordic Panel consisting both of scientists and relevance persons to perform the general evaluation of the funding. The Panel was assigned to identify the strengths and weaknesses of key thematic areas (main fields) as well as the programme in general. The Panel were to make recommendations for the future to strengthen the research and the SLF procedures for managing the research funding.

The Panel's assessment work was organised into four working groups (Table 2) comprising the seven largest main fields (among the 12 in total) and just over 87 per cent of the reported projects.

The Panel met in Stockholm twice, on December 10, 2008 and on February 11–12, 2009. At the first meeting, presentations were given by Hans-Örjan Nohrstedt from Formas and by Jan Rundqvist and Eva Pettersson from SLF. At the second meeting, Else-Marie Mejersjö from the Swedish Board of Agriculture (SJV) gave a presentation and answered the questions raised by the Panel. The Panel's work was supported by Ms Viktoria Halltell and Mr Anders Franzén of Formas and by Dr Hans-Örjan Nohrstedt of Formas.

Table 2. Working groups in the seven main-fields.

Persons	1st Main field	No. of Proj. 1st	2nd Main field	No. of Proj. 2nd	Total no. of Proj.
B Dahl Jensen E S Kristensen G L Serikstad	Crops and plants – Agriculture	58	Horticulture	35 (excl econ & market = 3)	93
T Krogstad S B Nilsson	Plant nutrient turnover	35	Pesticides	14	49
T Löken J T Sörensen P Jonsson	Animal production – Domestic animals	43			43
I P Laurila M Börjesson	Economy and market	17 (incl 3 from horticulture)	Working environment	14	31
<b>Total</b>		<b>153</b>		<b>63</b>	<b>216</b>

In the first meeting, the Panel agreed upon the work process and timetable, familiarised itself with the material provided for the evaluation, and agreed upon the need for some additional material and statistics to be compiled for the use of the Panel.

In between the meetings, the Panel members worked group-wise to write up thematic in-field-reports assigned; having access to all the material provided by SLF and Formas, e.g. original proposals, reports from PIs, evaluation reports from the distance reviewers, reprints and final reports to SLF (occurring for some 30 per cent of the projects).

During the second meeting, the Panel discussed the in-field reports presented by the thematic working groups, confirmed the assessments on the thematic areas and the programme in general, and agreed on the structure of the final report and the general recommendations.

At the level of evaluating the thematic areas, the Panel structured the work according to the following questions:

#### *A. Scientific quality*

1. Has there been a clear scientific rationale for the research?
2. Have the methods used been appropriate and up-to-date?
3. Have the projects been led by people with sufficient academic merit?
4. Has the scientific production, in the form of international peer reviewed articles, been quantitatively and qualitatively satisfactory?

5. Has the research been visible enough at international conferences?
6. Has the research to a reasonable extent used obvious possibilities for national and international cooperation?
7. Has the research contributed to the education of the next generation of scientists by opening projects for students at different levels (MSc, Lic, Dr)?

#### *B. Societal relevance and gain*

1. Has the research been attributed to important and up-to-date issues for Swedish and Nordic agriculture?
2. Has the research been attributed to important conditions for a sustainable development (in its different dimensions) of Swedish and Nordic agriculture?
3. Has the research produced new and important knowledge that is possible to use in a reasonable time-frame?
4. Has the research and its results been communicated to advisors and farmers to a satisfactory extent?

In addition to the thematic level approach, the SLF funding programme was evaluated in general. The Panel evaluated the strengths, weaknesses, opportunities and recommendations for the future by answering the following questions:

1. Which have been the most important strengths?
2. Which have been the most important weaknesses?
3. Has the research fulfilled the goals of the R&D programs of SLF and the intentions of the Swedish Board of Agriculture? Are there evident differences between thematic areas or programs in this sense?
4. Are there decisive issues of a sustainable development that have not been subjected to research?
5. Which are the most important recommendations for the future?

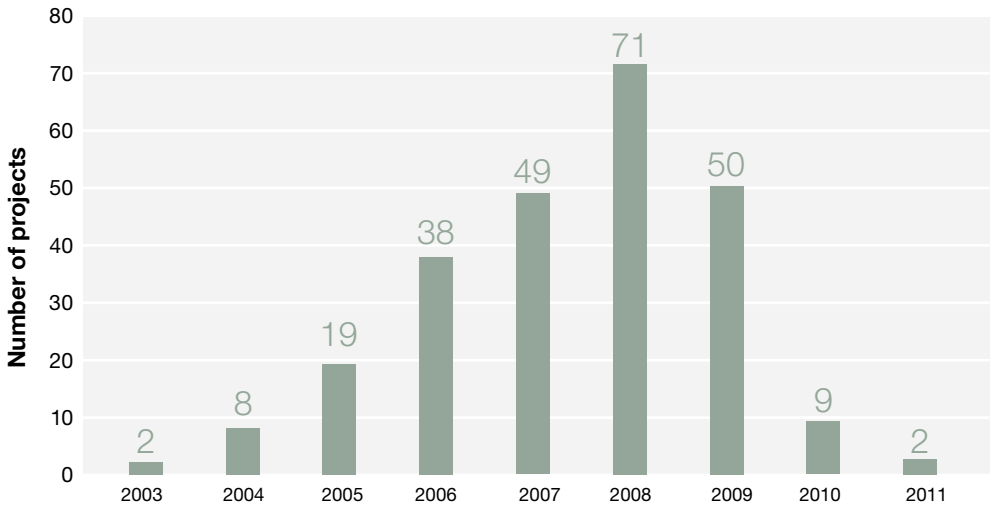
Furthermore, the Panel also evaluated the SLF programmatic approach, funding procedures and process-related issues and made general recommendations on these.

### **An overview of the SLF-funded research process from 2002–2007**

The amount of reinvested taxes for research and development managed through SLF has increased during the 2002–2007 period studied. The first year, 2002, it was 15 MSEK.

The year following the period studied, 2008, the sum total had increased to more than 80 MSEK. Consequently, the number of projects funded during the studied years 2002–2007 has increased, as shown in Figure 1 documenting the number of SLF-funded projects by their final years of funding. Most of the projects apply for and receive funding for two or three consecutive years.

**SLF-projects/final year**



**Figure 1. SLF-funded projects per their final year of operation.**

The aims of the funding, as expressed by the decisions from the Swedish Board of Agriculture, have varied over the years, but a contribution to a sustainable development of agriculture, including reduced environmental impact, has generally been important. SLF aims to fund research that has relevance for on-farm production and that will lead to results that are applicable at the farm-level in the long or short term.

Appendix 1 provides general information related to the project portfolio evaluated, including information on project-related output activities. The division into small and large projects is determined by the average project-funding level by SLF (0.84 MSEK). The majority of projects are fairly small in size: 146 projects received a total funding equalling or less than 1.0 MSEK (Figure 2).

### Number of projects in relation to funding size

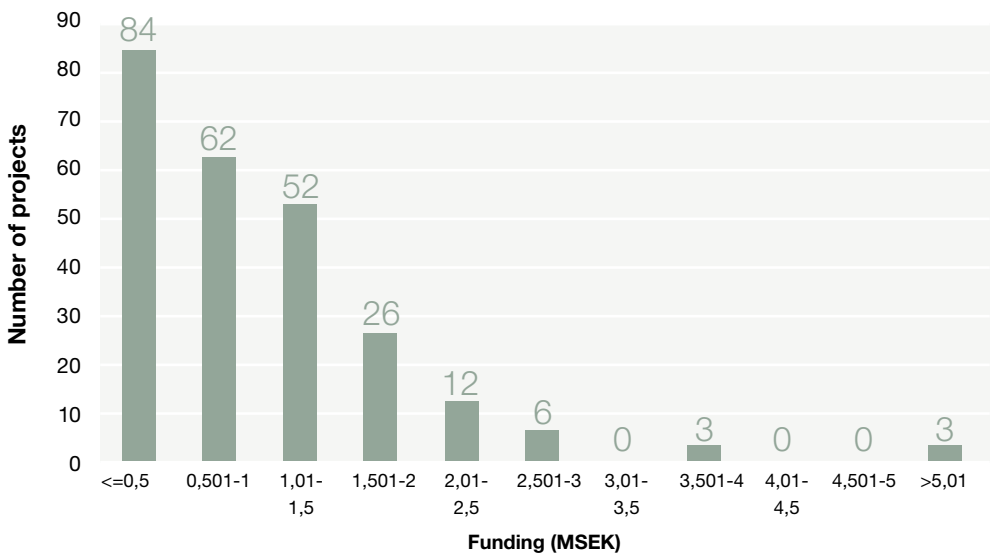


Figure 2. The number of projects in relation to funding size.

The total SLF funding being subjected to this evaluation was 208 MSEK. With external co-funding the total funding volume was 267 MSEK. The total number of reported projects was 248 (Appendix 1).

Regarding the scientific output, the mean number of peer reviewed articles per project was 0.3, and the mean number per MSEK was 0.29 articles. 39.5 per cent of the projects have appeared at scientific conferences, 29.4 per cent have had international scientific cooperation, and 54.8 per cent of the projects have contributed to university education (Appendix 1).

Regarding practical output, 39.1 per cent produced popular publications with an average 0.4 publications per project and 0.36 publications per MSEK invested. 50.8 per cent of the projects have appeared at practice conferences (addressing farmers and stakeholders), 30.2 per cent have had presentations on courses and 26.6 per cent presentations during field trips. 48.8 per cent were engaged in dialogue through reference groups, radio, TV etc. (Appendix 1).

SLF has established procedures for managing the use of the funds. These relate to the whole process, from initiating calls for proposals to follow-up on projects. Information

on the procedures and proposal calls is available from the SLF home page on the internet at [www.lantbruksforskning.se](http://www.lantbruksforskning.se). Appendix 2 provides a summary of calls for proposals during 2002–2007, including both redistributed tax money as well as money from the farmers, and a presentation of each area.

Proposals are examined by SLF according to several criteria, including the research topic, economic issues, material and methods, competence of applicant, dissemination strategy and relevance for the farmers (Appendix 3). The proposals are at first ranked according to relevance. At the committee meetings, the other criteria are also taken into account before the final decision on which proposals to approve is taken. The share of scientists in the SLF's selection/grant awarding committees varies but is on average just over one third. Committee Chairs are often farmer's representatives. The success rate of a research proposal from an SLF call is around 30 per cent.





# Scientific quality and relevance of SLF-funded research by thematic areas

Across the two fields of agriculture and horticulture, the most important scientific sub-fields covered included plant husbandry, plant diseases and product quality, followed by a lower number of projects related to breeding and genetics and plant insect pests.

## **Agricultural and horticultural research**

Ninety-five projects were reported to Formas in the thematic area of Agricultural and horticultural research. In this report, recommendations can only be made on the basis of information from the submitted project reports. The 95 projects included 60 projects related to agriculture and 35 projects related to horticulture.

The agricultural projects mainly deal with the following plants: cereals, potatoes, oil seed crops and fodder crops. 25 per cent of the projects involve potatoes. The reported horticulture projects include 13 projects dealing with fruit production, most of them concerning apples. Four projects concern berries, including strawberries, raspberries and other *Rubus*-species. Six projects deal with outdoor vegetables, with carrots as an important crop. Greenhouse production is dealt with in 11 projects. Trees for parks are dealt with in 3 projects.

Agricultural projects were funded with a total of 61 MSEK from SLF, and this was 85.6 per cent of the total funding for these projects. Horticultural projects were correspondingly funded with 38 MSEK from SLF, contributing 91.7 per cent of the total funding for these projects. The average funding per project for the two subject groups was 1.19 MSEK. SLF contributed an average of 87.6 per cent of this budget.

Overall, approximately 65 per cent of the projects related to applied research, with development work, trials, information and other project types making up the remaining 35 per cent. Horticulture has received a rather large proportion (38 per cent) of the total SLF funding, and the percentage is similar

Table 3. Summary of project data for the thematic field of Agricultural and horticultural research.

Property	All reported projects	Projects with final year 2007 or earlier		Projects with final year after 2007	
		Small	Large	Small	Large
Proportion of projects in relation to final year and size (%)	100	16.7	25.0	15.0	43.3
Proportion of projects having cooperation (steering/ref group) with other organisations (%)	65	70	47	44	81
SLF-funding (MSEK)	61	3.7	21.1	2.9	33.2
SLF-funding, mean per project (MSEK)	1.02	0.37	1.41	0.32	1.28
SLF's share of funding (%)	85.6	97.9	86.5	92.8	83.3
Number of peer-reviewed articles per project	0.1	0.0	0.4	0.0	0.1
Number of peer-reviewed articles per MSEK*	0.11	0.0	0.25	0.0	0.06
Proportion of projects appearing at scientific conferences (%)	43.3	40.0	66.7	22.2	38.5
Proportion of projects with international scientific cooperation (%)	25.0	30.0	26.7	0.0	30.8
Proportion of projects with national scientific cooperation (%)	56.7	40.0	73.3	33.3	61.5
Proportion of projects contributing to university education (%)	55.0	70.0	40.0	44.4	61.5
Proportion of projects with presentations on courses (%)	30.0	20.0	33.3	33.3	30.8
Number of popular publications per project	0.3	0.3	0.5	0.1	0.3
Number of popular publications per MSEK*	0.28	0.79	0.29	0.32	0.23

\* MSEK total funding (SLF + other)

when co-funding is included (37 per cent). This proportion seems to be higher than one might expect the value of the Swedish horticultural production to be in comparison to the agricultural production value. However, the horticulture programme has solely received redistributed tax money from SLF, whereas farmers have contributed additional funds to other SLF programme areas (Appendix 2).

Out of the 95 projects, 67 were granted to SLU (70.5 per cent) as recipient, 2 were granted to SU, 6 to private companies, and the remaining to other institutions and extension services.

The 95 projects were led altogether by 57 individual scientists, i.e. on average each scientist led 1.67 projects. Three scientists led 4 projects each. Fifty-six projects were led by male applicants and 39 by female applicants.

International collaborators were involved in 25 per cent of all projects, and on average 4.5 per cent of all projects had national collaborators. It may well be that some projects with international collaboration also had national collaborators, so the percentage of projects without collaborators is somewhere between 0–43.3 per cent. Sixty-nine projects were based at the Universities SLU and SU, and accordingly 55–57.5 per cent of the projects contributed to university education (in the respective fields of agriculture and horticulture).

Within the field of agriculture 0.1 peer reviewed papers were produced per project, and within horticulture 0.3 papers. In addition, the number of manuscripts submitted was 0.65 and 0.4 respectively.

## **A. Scientific quality in the thematic area of Agricultural and horticultural research**

### **1. *Has there been a clear scientific rationale for the research?***

The projects embrace the whole chain from breeding of new cultivars to primary production and post-harvest and storage issues. Most of the projects are applied research projects, directly related to problems appearing in practical agriculture and horticulture, dealing either with biological or technical problem solving. Many of the project hypotheses are tested in field and in greenhouse studies. Some test the possible use of equipment and techniques in primary production, whereas others include laboratory or modelling work. Some are implementation projects to test whether techniques developed in other countries may also be applicable under Swedish conditions. A few projects deal with more basic science-related issues, including for instance molecular marker techniques and proteomics. In general, the scientific rationale seems clear in the projects, and the evaluation scores on average were 3.80 for agricultural research and 3.42 for horticultural research (see Appendix 4), but the

projects embrace a wide range of subjects and techniques – from very applied to rather 'high-tech'.

2. *Have methods used been appropriate and up-to-date?*

Many of the horticultural projects have been performed under greenhouse conditions and include testing of technical equipment and laboratory analyses. Most the projects within agriculture have been carried out on research stations/private farms (Fältförsök/Field tests). This methodology ensures high relevance for similar contexts. If there are several replicates over several years across different conditions (e.g. soil and climate) this might lead to general knowledge of excellent scientific quality. However, given the relatively small budgets this seems rarely to be the case. On the contrary, in some cases trials have been abandoned because of "outside disturbance" (e.g. droughts and no permission to irrigate). The evaluation score for methods were 3.61 for agricultural research and 3.65 for horticultural research (see Appendix 4), and it is our impression that the scientific quality in general is good and sufficient to generate this type of context dependant knowledge.

3. *Have the projects been led by people of sufficient academic merit?*

Many of the applicants have a PhD degree, others an MSc degree and they should therefore be competent to carry out the research projects.

4. *Has the scientific production in the form of international peer-reviewed articles been quantitatively and qualitatively satisfactory?*

With the given project periods and grant amounts it may be difficult to produce results that can be published in papers internationally in scientific, peer-reviewed journals. Many results may be published several years after the projects have been finalised, as it may be that some results must be confirmed in several experiments. Funding may therefore be sought elsewhere before publication is possible. Deliverables in the form of peer reviewed papers do not seem to be prioritised substantially in the grant proposal calls or in the evaluation process. It is possible that results are published, but this may then happen a long time after the SLF grant period, and thereby publications are perhaps not reported to SLF. If we look at the projects finalized before 2008

within agriculture, there are no international papers in small projects and only 0.4 in large projects. This relatively low level of international papers must be expected when you are, for instance, working with studies based on trials on a few private farms. The evaluation score for agricultural research was 2.54, which is a bit below the overall average.

Within horticulture most projects seem to be carried out at research stations, where it is possible to control more factors compared to trials on private farms. As is shown in Table 3, 0.6–0.7 papers have been produced per finalized project, which is close to the total average. The evaluation score was 3.14, which is a bit above the overall average.

5. *Has the research been visible enough at international conferences?*

Research results have mainly been presented at national seminars and meetings. It would be beneficial if more results were also presented at international meetings. Again, this may already be the case, but perhaps after the final reports have been submitted. The evaluation score was 2.62 for agricultural research and 3.27 for horticultural research.

6. *Has the research to a reasonable extent used obvious possibilities for national and international cooperation?*

International collaboration does not seem to be given priority in grant proposal calls and therefore is not a priority in the consequent execution of the projects, although some projects have an excellent international collaboration component.

7. *Has the research contributed to the education of the next generation of scientists by opening projects for students at different levels (MSc, Lic, Dr)?*

Sixty-nine projects were based at the Universities SLU and SU, and accordingly 55 per cent and 57.5 per cent of the projects contributed to university education (in the respective fields of agriculture and horticulture). The evaluation score was 2.20 for agricultural research and 3.05 for horticultural research.

## **B. Societal relevance and gain in the thematic area of Agricultural and horticultural research**

### *1. Has the research been attributed to important and up-to-date issues for Swedish and Nordic agriculture?*

Important and relevant questions for Swedish and Nordic food production and production of ornamentals etc. have been studied in the horticultural projects, concerning better husbandry with plant nutrients and development of better non-chemical plant protection methods. Some of the projects have been working with integrated plant protection, through biological methods, more efficient use of pesticides and better techniques for spraying. Use of reduced light as a growth regulator for potted plants is an interesting alternative to pesticides. Many of the questions asked in the projects are relevant for both conventional and organic farming. Some of the projects work with more effective plant nutrient supply via studies of irrigation systems in greenhouses.

Important and relevant questions for Swedish and Nordic food production have also been studied in the agricultural crop science projects. Better use of plant nutrients and better fertilization has been the focus of several of these projects. Minimum tillage, improved methods for analysis and more effective methods for plant protection have also been studied. Improved knowledge about energy crops is also an important subject. Plant breeding and the more genetically oriented projects have been carried out with new varieties of oat, potatoes and grass/clover, with better quality and suitability for changed climate conditions. Within the plant protection projects, cereals and potatoes are the most common crops. Alternatives to pesticides and reduced use of pesticides are important topics. The aims of several projects are to increase production efficiency, increase income, expand the geographical production area and improve product quality, and with that improve the possibilities for continued Swedish food production. The average evaluation score was 3.8 for the agricultural research and 4.0 for the horticultural research.

### *2. Has the research been attributed to important conditions for a sustainable development (in its different dimensions) of Swedish and Nordic agriculture?*

Requirements for a sustainable development for Swedish

and Nordic agriculture are among the important and relevant questions for agriculture. Sustainability can be divided into ecological, economical and social sustainability, and the main impression is that most of the projects have addressed questions relevant to one or more of these aspects of sustainability. The following are examples of such questions, related to the different aspects of sustainability.

#### *Ecological sustainability*

- Reduced use of pesticides: better spraying techniques, resistant varieties, reduced light as a growth regulator, use of non-chemical plant protection, better knowledge of the biology of harmful organisms.
- Reduced fertilization and loss of nutrients: better fertilization practices, purification and recycling of nutrient solutions in greenhouses, more durable clover varieties, more knowledge about irrigation effects
- Energy crops: use of hemp

#### *Economical sustainability*

- More effective use of fertilizers and pesticides, less waste of products through better storage methods, better varieties, better knowledge of the biology of harmful organisms and economic thresholds, breeding for consumer preferences.
- Food safety: reduced content of cadmium in wheat

#### *Social sustainability*

The projects do not really question social sustainability.

Organic farming has not been emphasized in the SLF calls for proposals. A few of the projects mention that the questions asked are important for both organic and conventional farming. Other institutions (Formas, SJV and SLU EkoForsk) had calls for proposals addressing projects for organic farming during the same period.

The average evaluation scores were 3.5 for the agricultural research and 3.8 for the horticultural research projects.

### ***3. Has the research produced new and important knowledge that is possible to use in a reasonable time-frame?***

The program grant proposal calls point out that the grants are to be used for information, education, development and extension work. Applied research, field trials and development work are mentioned as relevant

working methods in the grant proposal calls and fast dissemination of the results is important. In general, the research has produced new and important knowledge for food production and the related themes, and the results can be used immediately. Most of the projects concern applied research, field trials and development work. In general, the results from such projects can be used in practice shortly after the projects have ended. A few of the projects concern more basic research. The limited amount of funding, the short duration of the project periods and the aim of the work contribute to results from some of these projects never reaching a form useful for practice.

Field trials at just a few sites reduce the usefulness of the results for growers located in other parts of Sweden and Scandinavia. Just 1–2 years of field trials, perhaps with extreme weather conditions, also reduce the usefulness of the results.

Some of the projects have been prolonged or delayed according to original project timeframes, and for some projects the final reports have not been submitted in time. This delays knowledge production, and can be negative if other projects with similar topics publish almost similar results before the SLF projects. The average evaluation score was 3.2 for the agricultural research and 3.5 for the horticultural research.

4. *Has the research and its results been communicated to advisors and farmers to a satisfactory extent?*

It is important that the research work and the research results are communicated to advisors and producers at different stages of the work, preferably from the beginning. Continuous contact with these target groups can be participation in projects groups, formal cooperation with organisations, field visits and other oral communication during the project period. Written communication with project information during the project period is also important. In some of the projects, reference groups with broad representation are an active and constructive part of the work. This way of involving different target groups could have been used in more projects to strengthen the communication with farmers, advisors and organisations.



Very few projects are co-financed by beneficiary organizations in addition to the money from SLF and SLUT. Funding from organisations and factories or own efforts, from for example 'Hushållningssällskap/agricultural society', can secure involvement and interest in the project work.

The amount of written and oral communication of results from the projects to advisors and farmers varies a lot. A few projects are characterised by a large publication activity through different channels. Unfortunately, there are also some projects that have not used the possibilities for communication in an adequate way. Oral presentation is an effective way of communication for those who are present, but it is impossible to reach the whole target group in this way. Field walks, meetings, seminars and lectures at SLU are examples of oral presentations in the projects. A few projects have been communicated by interviews in newspapers. Written communication in periodicals can reach different target groups. This type of communication will have a restricted lifetime as such periodicals are often a "fresh product". "Nytt om forskning" ("News on Research") and "Forskning lönar sig" ("Research pays off") are periodicals from SLF. These give short information summaries about the project results. "Mer om forskning" is a thematic periodical from SLF, which collects results over several years.

Presenting project and results via the Internet can be an effective way of communicating results to many people and also of making the communication more permanent. But the results have to be placed where they can be easily accessed. Some of the projects have published their results on one or more websites. SLF has its own website with project information. The possibilities for knowledge dissemination here are not fully utilized. The SLF website, together with [www.loftinfo.se](http://www.loftinfo.se) are useful places for collecting knowledge from the projects, and sources where different target groups can search for, and get, easy access to information.

The average evaluation score was 3.3 for agricultural research and 3.9 for horticultural research.

## Plant nutrient turnover and pesticide – related research

The main research topics in the projects evaluated in plant nutrient turnover are:

- Gas flux (emission from beef production systems and from cattle litter)
- Planning (field management and land-use planning)
- Recycling (nutrients in animal farming)
- Soil processes (P balance studies, N and K fertilization and mineralization in soil)
- Leaching (N and P leaching related to cultivated practice and soil content of nutrient)

**Table 4. Summary of project data for the thematic field of Plant nutrient turnover and pesticides –related research.**

Property	All reported projects	Projects with final year 2007 and before		Projects with final year after 2007	
		Small	Large	Small	Large
Proportion of projects in relation to final year and size (%)	100	30.3	6.1	36.4	27.3
Proportion of projects having cooperation ( <i>steering/ref group</i> ) with other organisations (%)	48	50	50	33	67
SLF-funding (MSEK)	29	2.9	2.2	5.5	18.7
SLF-funding, mean per project (MSEK)	0.89	0.29	1.12	0.46	2.08
SLF's share of funding (%)	94.9	94.3	100.0	97.3	93.7
Number of peer-reviewed articles per project	0.2	0.3	0.0	0.0	0.2
Number of peer-reviewed articles per MSEK*	0.16	1.0	0.0	0.0	0.1
Proportion of projects appearing at scientific conferences (%)	24.2	20.0	50.0	8.3	44.4
Proportion of projects with international scientific cooperation (%)	12.1	20.0	100.0	0.0	0.0
Proportion of projects with national scientific cooperation (%)	18.2	10.0	50.0	16.7	22.2
Proportion of projects contributing to university education (%)	36.4	20.0	100.0	25.0	55.6
Number of popular publications per project	0.3	0.4	0.5	0.2	0.3
Number of popular publications per MSEK*	0.32	1.31	0.45	0.36	0.15

\* MSEK total funding (SLF + other)

For pesticide research the main research topics are related to leaching, cultural practice and risk assessments in food production. Summaries of the data and evaluation scoring of this thematic field are provided respectively in Table 4 and in Appendix 4.

## **A. Scientific quality in the thematic area of Plant nutrient turnover and pesticide – related research**

### *1. Has there been a clear scientific rationale for the research?*

#### *Gas flux, planning and recycling (9 projects)*

The need for research is well formulated and explained. The average evaluation score is 4.1, which shows that the research is very well motivated.

#### *Soil processes (10 projects)*

The research goals are well formulated and for most of the projects the reasons why new information is needed is well argued. The topics are highly relevant. The average evaluation score is 4.5, which shows that the research is very well motivated.

#### *Leaching (16 projects)*

The overall impression of the evaluation is that the topics studied are highly relevant and scientifically well founded. The projects mostly deal with problems related to P and N, with both an agricultural and environmental focus. The average evaluation score is 3.9, which shows that the research is well motivated.

#### *Pesticides (14 projects)*

The majority of the projects in this main group are classified as small projects and 57 per cent and 29 per cent respectively are applied research and development work.

The overall impression of the evaluation is that the topics studied are highly relevant and scientifically well founded. For some of the projects the topic to be studied is of international interest. The average score is 4.07, which shows that the research is very well motivated.

### *2. Have the methods used been appropriate and up-to-date?*

#### *Gas flux, planning and recycling*

The method description is a very important part of a research application, and the results are entirely dependent on how the experiments are performed. In this group of projects the

variation in how the methods are described is large. For some of the projects the methods used are not described at all and are impossible to evaluate. For other projects the methods are very well described and well adapted to the planned investigations. Standard and widely tested methods are used for most of the projects. The average evaluation score is 3.8.

#### *Soil processes*

The overall impression is that standardized and traditional methods that are relevant and well adapted for the investigations are used. The type of scientific methodology varies, from field sampling of soil and use of data from existing databases to relatively newly developed methods for chemical extraction and nitrogen measurements. The average evaluation score is 3.3.

#### *Leaching*

The method descriptions were generally too weak to evaluate the quality of methods used, and the type of methodologies used varied considerable from field plot studies to chemical laboratory studies. The principles of methods used were in general appropriate and based on sound scientific knowledge. The average evaluation score is 3.5.

#### *Pesticides*

The method description is a very important part of a research application, and the results are entirely dependent on how the experiments are performed. There is a very large variation in how the methods are described. For some of the largest projects the methods used are not described satisfactorily (no papers are available) to enable evaluation of how the research is performed. For other projects the methods are very well described and well adapted to the planned investigations. The average score is however 4.2, which is very good.

### *3. Have the projects been led by people with sufficient academic merit?*

#### *Gas flux, planning and recycling*

The reviewers have not had access to the project leaders CVs. The information is mainly based on academic degrees and topics of work. Most of the project leaders hold a Ph.D. within the topic of the research and work at scientific institutions. The overall impression is that the project leaders are merited and well qualified. The average evaluation score is 4.2.

### *Soil processes*

With a few exceptions, where it is impossible to evaluate the project leader based on the available information, the project leaders are well merited and qualified to carry out the project. The average evaluation score is 3.4.

### *Leaching*

The reviewers have not had access to the project leaders CVs. The leaders hold a Ph.D. within the topic of the research and they should, based on this, be well qualified. The average evaluation score is 3.5.

### *Pesticides*

The reviewers have not had access to the project leaders CVs. The information is mainly based on academic degrees and topics of work. Most of the project leaders hold a Ph.D., have long experience within pesticide research and work at scientific institutions. It is also emphasized by the reviewers that some of the project leaders are well represented in ISI indexed journals. The overall impression is that the project leaders are merited and well qualified. The average score is 4.33.

## ***4. Has the scientific production in the form of international peer-reviewed articles been quantitatively and qualitatively satisfactory?***

### *Gas flux, planning and recycling*

The production of peer reviewed international articles is not satisfactory. Only one article has been written. Despite the majority of projects being applied research there is a potential for scientific international publications to be written in some of the projects.

### *Soil processes*

The production of peer reviewed international articles is not satisfactory. Only one article has been written. Despite the majority of projects being applied research there is a potential for scientific international publications to be written in some of the projects.

### *Leaching*

The production of peer reviewed international articles is low, with 6 articles written or available as manuscripts so far. The potential for scientific international publications, however, seems to be good.

### *Pesticides*

As an average for the whole group the number of peer reviewed international articles and manuscripts per project is 0.6 and 0.64, respectively. The variation between projects is, however, large. Ten out of 14 projects have produced no written articles. On the other hand, one of the small projects has produced 5 peer reviewed articles and another has produced 3, with a total cost of 0.75 MSEK, which is quite impressive. It is pointed out that some of the projects deal with topics of international interest and international publications should have been expected. The average score for the group is 2.0.

The overall impression is that there is a very low rate of scientific publications in peer reviewed journals. For all projects in plant nutrient turnover the number is 0.2 per project and there is no real difference between small and large projects. The total number is 0.16 per MSEK. For the pesticide projects, the total number is 0.77 per MSEK, which is high compared to the average for all projects financed by SLF (0.29).

### *5. Has the research been visible enough at international conferences?*

#### *Gas flux, planning and recycling*

Only 3 out of 9 projects have had presentations at international conferences. The research topics are of international interest and a higher international presentation rate is expected.

#### *Soil processes*

Only 2 out of 10 projects have had presentations at international conferences. The research topics are of international interest and a higher international presentation rate is expected.

#### *Leaching*

Seven out of 16 projects have had presentations at international conferences. There is a large variation between projects, from no presentations to 4 presentations for one of the large projects. In this group the overall impression is that international conference presentation is satisfactory.

The average score for the plant nutrient turnover group is 2.85, with 24.2 per cent of the projects represented at international conferences. Large projects have much higher

presentation rates than small projects, which is also reflected by more applied topics of national importance being small projects. A higher rate of international presentations for projects of these topics is expected compared to that reported by the project leaders. This aspect is important with regard to increasing international collaboration in the future.

#### *Pesticides*

Only 4 out of 14 projects (28.6 per cent) report being represented at international conferences. There is a clear relation between a high publishing rate and presentation at conferences. These projects (3–4) have an internationally developed network and a couple of them have attended several conferences where information is spread worldwide. The whole group is however very heterogeneous. For 6 of the projects the information necessary to evaluate the question is not provided. The average score of 3.25 is based on information from approximately only half of the projects financed by SLF. The overall impression is that the topics studied in most of the projects should have international interest. Thus a higher rate of international presentations than reported by the project leaders is expected.

### ***6. Has the research to a reasonable extent used obvious possibilities for national and international cooperation?***

#### *Plant nutrient turnover*

For this topic the evaluation is very congruent for all subtopics in the main group. The proportion of projects with national and international cooperation is 12.1 per cent and 18.2 per cent, respectively, with more cooperation in large projects than in small projects. For some of the small projects working on local national topics international cooperation is not crucial for the project outcome, but more national cooperation would have been requested. For projects working on more internationally relevant questions more cooperation would have increased the value of the project. The average evaluation score is 2.76, which is not satisfactory as an evaluation score for the whole group.

#### *Pesticides*

Some of the projects are only of national interest and the proportion of projects with national cooperation is 50 per cent, which is good. As reported for conferences and international publishing, 3–4 of the projects have a broad international network and collaboration and they have scientists who are sought-after as collaborating partners, e.g. in EU projects.

The overall impression is that the projects have used the possibilities for national and international collaboration satisfactory. The average score is 3.30, which is the highest among all fields evaluated for this question.

*7. Has the research contributed to the education of the next generation of scientists by opening projects for students at different levels (MSc, Lic, Dr)?*

*Plant nutrient turnover*

The proportion of projects contributing to university education is 36.4 per cent. This is very positive and projects have contributed to both course activity and to education of students at master and Ph.D. levels. There are, however, many projects performed at university departments that have shown no student activity, even if the topics should be very suitable for such activity. The average evaluation score for the whole group is 2.63.

*Pesticides*

The proportion of projects contributing to university education is 64.3 per cent. There is, however, large variation within the group. For eight of the projects (57 per cent), there is no information available to enable this question to be evaluated. The remaining projects have contributed to a large extent through university courses and four PhD-theses have been a result of this research, which is a very good outcome. The average score for the projects that can be evaluated is 3.33, which is the highest among all fields evaluated for this question.

In five out of eight questions regarding evaluating the scientific quality, pesticides as a group has the highest average score among all fields evaluated.

**B. Societal relevance and gain in the thematic area of Plant nutrient turnover and pesticide-related research**

*1. Has the research been attributed to important and up-to-date issues for Swedish and Nordic agriculture?*

*Gas flux, planning and recycling*

This group includes many different topics, such as improvement of soil sampling for precision farming, losses of nutrients from foraging and from stables and investigations on why farmers use more fertilizers than recommended. The average evaluation score is 4.2, which implies that the research is very relevant.



### *Soil processes*

The projects are mostly on nutrient availability in soil after spreading different kinds of manure; how the nutrient availability affects the uptake and the quality of the crop. These questions are highly relevant for agriculture. The average score is 4.4, which shows that the research is attributed to important questions.

### *Leaching*

Ten out of 16 projects were on reducing losses of phosphorous from fields, mainly with an environmental focus. The average score is 4.7, a very high average score, indicating that the research is very relevant.

However, research in the entire thematic area is highly focused on reducing losses from the field. No research was performed on how phosphorous could be used more efficiently, for instance by using precision farming technology, timing and placements of the manure and the fertilizers. Very little research is performed on the quality aspects of the plant. Treatment of manure through fermentation, aeration, separation etc. is a question of increasing importance that should be investigated under Swedish conditions.

### *Pesticides*

Regarding the implementation of the Water Framework Directive, the results from many of the projects in this area will be of high interest. Several projects are on the use of pesticides in water protection areas. Some of the projects have helped the local authorities and advisors to develop a way for the farmers to manage their crops at the same time as the water is protected. The results from these projects have served as a model for both other local authorities and farmers in other parts of Sweden. The average score is 4.4, which shows that the research has been highly relevant.

## ***2. Has the research been attributed to important conditions for a sustainable development (in its different dimensions) of Swedish and Nordic agriculture?***

### *Gas flux, planning and recycling*

The projects deal with questions like losses of nutrients from stables and forage and the overuse of mineral fertilizers. These questions are important from an environmentally sustainable development perspective. Three projects deal with both environmental and economical sustainability. The

average score is 4.2, which shows that the research is very important for the development of sustainable agriculture.

#### *Soil processes*

The projects are mostly on nutrient availability in soil; how much is available for the plant and how this affects the uptake by the crop. These questions are interesting both economically and environmentally. Precision farming and methods for predicting nutrient availability in soil will be even more important in the future. The average evaluation score is 3.6.

#### *Leaching*

The majority of the projects only relate to environmental sustainability. Few projects have a perspective that includes both economical and environmental sustainability. One project has managed to relate to all three aspects of sustainability. The average evaluation score is 4.0.

#### *Pesticides*

Research has mostly been attributed to projects concerning losses of pesticides to the environment. A few projects deal with the use of pesticides to work out strategies for difficult pests and the use of pesticides in water protection areas. The average score is 4.1, which shows that the research has been on very important conditions for sustainable development.

### ***3. Has the research produced new and important knowledge that is possible to use in a reasonable time-frame?***

#### *Gas flux, planning and recycling*

Only three out of nine projects were finished and had presented conclusions and recommendations. Some of these results can be taken for immediate use by farmers or advisors. The average score for the finished projects is 3.7.

#### *Soil processes*

Most projects indicate that the availability of nutrients in the soil depends on the manure added, the soil treatment or the qualities of the soil. It is satisfying that the research includes all of the macronutrients. The average score is 3.8.

#### *Leaching*

The research shows a complex picture of how the tillage and the variability of the soils affects losses of nitrogen and phosphorous. The results on phosphorous mostly concern the general understanding of how large losses can be expected from certain soils or from fallow conditions. A few projects

give clearer recommendations on when and how to treat the crop. The average evaluation score is 3.9.

### *Pesticides*

Research has resulted in improved knowledge of pesticide risks and better cropping practices. About half of the projects involve or develop a certain macro-model showing the risk of leaching of pesticides. The model developed has been successfully utilized by researchers together with advisors and authorities. The average score is 3.6, which shows that important knowledge has been produced.

Projects close to the production usually present clear recommendations to the farmers. The results from many research projects concerning leaching of phosphorus are probably of greater interest for the authorities than for the farmers at this stage.

Several of the projects are not finished and therefore recommendations and conclusions are not yet presented.

### *4. Has the research and its results been communicated to advisors and farmers to a satisfactory extent?*

#### *Gas flux, planning and recycling*

Some projects had presented a communication plan. Even though the projects are not finished, information on the project can be found on homepages, in magazines read by farmers etc. This is very good and should stand as a model for other projects. The rating of the communication varies, and there are projects on each level from 1 to 5. The average evaluation score is 3.0, which implies that on average the communication is acceptable.

#### *Soil processes*

Eight out of ten projects had, at the date of submission of the survey, not communicated the results to advisors and farmers. The reason for this is probably that many of the projects were not finished. Another reason for the lack of communication to farmers and advisors is probably a question of priorities, since the efforts of producing scientific publications seem higher. The average evaluation score for the two projects that were finished and had communicated their results is 4.5.

#### *Leaching*

Seven out of 16 projects were not finished and cannot be judged in this matter. Generally the researchers seem to

have communicated their results quite well, at least as far as information to advisors is concerned. More complex projects, trying to solve several questions, seem to have handled the information to farmers and advisors quite well. The average score is 3.6, which implies that the information has been communicated well. A more extensive communication of the results would be good for the majority of projects.

#### *Pesticides*

Some of the projects have handled the communication aspect very well. Fifty per cent of the finished projects have been rated 5, and 38 per cent were rated as a 3. The rest were rated as a 1.

One project successfully involved a dialog group including farmers, advisors and the authorities. Another included the food industry. These kinds of arrangements can ensure the relevance, the quality and the communication of the project.

Some projects handle the communication aspect very well, using the media, speaking at courses, involving farmers in dialog groups etc. The majority of the projects, however, do not communicate to a satisfactory extent.

### **Animal production research**

In total, 43 projects concerning animal production and domestic animal research are included in the evaluation (see Table 5 and Appendix 4). Main research topics performed include infections such as enteritis and joint lesions in pigs, anthelmintic use and resistance in sheep, vaccine development for use in chickens, feed and feeding regimes including nutrition of lambs and forage for dairy cows, breeding and housing of production animals, and food quality issues for men such as boar taint.

The projects fall in to five research areas:

- Animal breeding and genetics, 4 projects
- Animal diseases, 16 projects
- Animal husbandry – technical, 2 projects
- Feeding and nutrition, 16 projects
- Quality of milk and meat, 5 projects

Half of the projects are still ongoing and have not yet ended, but this is taken into account in the evaluation to some degree.

**Table 5. Summary of project data for the thematic area of Animal production research.**

Property	All reported projects	Projects with final year 2007 and earlier		Projects with final year after 2007	
		Small	Large	Small	Large
Proportion of projects in relation to final year and size (%)	100	27.7	17.0	23.4	31.9
Proportion of projects having cooperation (steering/ref group) with other organisations (%)	72	77	50	73	80
SLF-funding (MSEK)	33	4.6	7.1	4.8	16.1
SLF-funding, mean per project (MSEK)	0.69	0.35	0.88	0.44	1.07
SLF's share of funding (%)	60.6	91.8	74.3	84.9	47.9
Number of peer-reviewed articles per project	0.6	0.2	0.8	0.1	1.1
Number of peer-reviewed articles per MSEK*	0.48	0.48	0.68	0.19	0.49
Proportion of projects appearing on scientific conferences (%)	48.9	46.2	62.5	27.3	60.0
Proportion of projects with international scientific cooperation (%)	61.7	46.2	100.0	54.5	60.0
Proportion of projects with national scientific cooperation (%)	53.2	76.9	62.5	27.3	46.7
Proportion of projects contributing to university education (%)	59.6	53.8	75.0	45.5	66.7
Number of popular publications per project	0.5	0.6	0.6	0.2	0.7
Number of popular publications per MSEK*	0.46	1.59	0.53	0.35	0.30

\* MSEK total funding (SLF + other)

## **A. Scientific quality in the thematic area of Animal production research**

One project in the animal husbandry – technical category and one project in the feeding and nutrition category were not research projects and could not be evaluated for their research quality.

### *1. Has there been a clear scientific rationale for the research?*

The research was in general well motivated. The average score for the projects was 3.4. For four projects, three in the feeding and nutrition area and one animal disease project, the project applications were deemed to be less well motivated (evaluation score 2).

### *2. Have the methods used been appropriate and up-to-date?*

The research methods used in the projects were in general seen as appropriate and up-to-date. The average score for the projects was 3.3. For three projects, two in the feeding and nutrition area and one in the area of animal diseases, the research methods were not deemed to be appropriate (evaluation score 2).

It should be noted that the content of the project descriptions did not allow a thorough evaluation of the research methods applied. The research methods were not evaluated in five of the projects.

### *3. Have the projects been led by people with sufficient academic merit?*

The research was in general managed by experienced and competent project leaders. The average score for the projects was 3.7. However, there was some variation among projects. In four of the projects, three in the feeding and nutrition area and one in the area of animal diseases, the project leaders were deemed to be less competent (evaluation score 2), and in one project in the feeding and nutrition area the project leader was not assessed as being competent at all (evaluation score 1).

### *4. Has the scientific production in the form of international peer-reviewed articles been quantitatively and qualitatively satisfactory?*

The production in terms of peer-reviewed papers was in general not fully satisfactory. The average score for the projects was

2.8. In 12 projects, it was not possible to evaluate quality because the projects had not reached a point where scientific papers had been produced or could be expected. For eight of the projects, six in the feeding and nutrition area, one in the area of animal husbandry – technical, and one in the quality of meat and milk area, the production of peer reviewed papers was deemed to be less than expected (evaluation score 2), and in two projects, one in the feeding and nutrition area and one in the area of animal diseases, scientific publication was not satisfactory (scoring 1 on evaluation). Some of the scores, however, rely on expectation more than actual production. In total, 14 peer-reviewed papers have been published from the 43 projects.

*5. Has the research been visible enough at international conferences?*

The projects in general have been well presented at international scientific conferences, with an average grading of 3.0, but with some variation. For five projects, four in the feeding and nutrition area, one in the area of animal diseases, appearance at conferences has been less than expected (scoring 2 on evaluation), and in two projects, both in animal diseases, the conference contribution was not satisfactory (evaluation score of 1). For eight of the projects this quality was not evaluated because the projects were at too premature a stage or scientific research was not expected as the outcome.

*6. Has the research to a reasonable extent used obvious possibilities for national and international cooperation?*

In general, the projects have exploited possibilities for strengthening their research through relevant national and international collaborations. The average score for the projects was 3.2. In seven projects the efforts at collaboration were seen to be less than those desired (evaluation score of 2): three of these were in the feeding and nutrition area, three in the area of animal diseases and one in the area of animal breeding and genetics.

*7. Has the research contributed to the education of the next generation of scientists by opening projects for students at different levels (MSc, Lic, Dr)?*

The support the projects have provided for education by involving students in the research varies across the projects and also across the research areas. The research area of animal diseases differs from the other four areas by having a low grading for this criterion. The average grade for the 16

research projects in the area of animal diseases was 1.9, while the other areas all obtain an average evaluation score of 3 or above.

## **B. Societal relevance and gain in the thematic area of Animal production research**

In the first evaluation phase, 14 of the total 43 projects have not been evaluated with regard to relevance and benefit.

### *1. Has the research been attributed to important and up-to-date issues for Swedish and Nordic agriculture?*

Although there is variation among the projects, most of them address important questions in animal production and the majority reach an evaluation score of 3 or 4. The four breeding projects and most of the 16 projects concerning animal diseases are good examples of relevant applied research. Projects dealing with feeding and nutrition for horses are also important, since the horse market is growing in the Nordic countries.

However, animal based production is currently changing dramatically, both in Sweden and globally, due to new technical possibilities, new expectations from society and changes in production conditions, such as changes in climate and biosecurity. These changes are not fully reflected in the current research and project portfolio. Emerging infections, and in particular vector borne infections, in relation to climate changes should be topics for future research for sustainable development of animal production. Furthermore, housing systems fitting current and future livestock production need to be developed and evaluated. Neonatal diseases and mortality in both pigs and ruminants are issues that should be included in future research.

### *2. Has the research been attributed to important conditions for a sustainable development (in its different dimensions) of Swedish and Nordic agriculture?*

There is considerable variation among the projects also in this aspect, but most of them have been evaluated as good (evaluation score of 3) or better (evaluation score of 4).

### *3. Has the research produced new and important knowledge that is possible to use in a reasonable time-frame?*

The majority of the projects have produced important knowledge for sustainability in Swedish and Nordic agriculture. Many projects, however, are, still in progress and possible



improvements could be expected. A minority of projects are relevant only for specific Swedish conditions and thus are not valid for the other Nordic countries.

*4. Has the research and its results been communicated to advisors and farmers to a satisfactory extent?*

Again, many of the projects are still in progress, especially those concerning animal diseases, and the results may be better communicated later. However, despite considerable variation also in this aspect among the projects, most of them have been communicated as could be expected (evaluation score of 3), or better (evaluation score of 4).

### **Economy and market-related research**

The main research topics in this thematic area are farm management and production economics issues, such as competitiveness and profitability of production, various aspects of sustainable farming, and economics of organic farming. Topics such as food marketing and labelling, development of local and regional food networks, and the multifunctional character of agriculture are also covered. Summaries of the data and evaluation scoring in this thematic field are provided in Table 6 and in Appendix 4, respectively.

Table 6. Summary of project data for the thematic field of Economy and market-related research.

Property	All reported projects	Projects with final year 2007 and earlier		Projects with final year after 2007	
		Small	Large	Small	Large
Proportion of projects in relation to final year and size (%)	100	38.5	23.1	15.4	23.1
Proportion of projects having cooperation (steering/ref group) with other organisations (%)	69	60	67	100	67
SLF-funding (MSEK)	9	2.0	3.2	1.0	3.2
SLF-funding, mean per project (MSEK)	0.72	0.39	1.07	0.48	1.06
SLF's share of funding (%)	75.1	88.7	65.1	100.0	74.0
Number of peer-reviewed articles per project	0.4	0.0	1.7	0.0	0.0
Number of peer-reviewed articles per MSEK*	0.42	0.0	1.0	0.0	0.0
Proportion of projects appearing at scientific conferences (%)	46.2	0.0	100.0	100.0	33.3
Proportion of projects with international scientific cooperation (%)	23.1	40.0	33.3	0.0	0.0
Proportion of projects with national scientific cooperation (%)	23.1	20.0	33.3	50.0	0.0
Proportion of projects contributing to university education (%)	61.5	40.0	100.0	100.0	33.3
Number of popular publications per project	0.6	0.6	1.0	1.0	0.0
Number of popular publications per MSEK*	0.64	1.35	0.61	2.11	0.00

\* MSEK total funding (SLF + other)

## A. Scientific quality in the thematic area of Economy and market – related research

### 1. *Has there been a clear scientific rationale for the research?*

A quarter of the projects can be evaluated as top quality research (scoring 4–5 on evaluation). One-half of the projects are purely oriented to solving a practical problem without scientific ambition, which at the same time makes the quality of resultant solutions questionable (evaluation score of 0). A quarter of the projects can be classified as small-scale pilot-studies (evaluation score of 2).

*2. Have methods used been appropriate and up-to-date?*

In most of the projects, the methods adopted are quite simple and standard. More emphasis and on and competence in the methodological aspects was needed. State of the art methods have been used in only two out of 16 studies.

*3. Have the projects been led by people with sufficient academic merit?*

In 8 out of 16 projects, competent and professional leadership has been involved, as is indicated by very good or excellent evaluation scoring (4–5). In the rest of the projects, the leader has had no formal researcher training or the question has not been reported correctly.

*4. Has the scientific production in the form of international peer reviewed articles been quantitatively and qualitatively satisfactory?*

In 4 out of 16 projects, conference papers and peer reviewed journal articles have been published or manuscripts are under preparation. This is understandable given the short time span from the start of the project. In the rest of the projects, no outputs have been recorded in this category. In some projects, the research approach does not allow high-level scientific output.

*5. Has the research been visible enough at international conferences?*

In 2 out of 16 projects, the results have been well discussed in high-quality conference presentations and at meetings organised by highly ranked scientific associations in this research area. In 3 more projects, one conference presentation has been carried out. In the rest of the projects, no record has been reported in this respect.

*6. Has the research to a reasonable extent used obvious possibilities for national and international cooperation?*

In one-half of the projects, there has been intensive national cooperation. In 6 out of 16 projects, collaborative action is completely missing (or has not been reported). In some projects, the results have also been broadly popularised and distributed through the domestic arena and outlets. Given that some of the projects have been presented at international scientific forums, international collaboration could have been more active.

*7. Has the research contributed to the education of the next generation of scientists by opening projects for students at different levels (MSc, Lic, Dr)?*

One project has produced a licentiate degree, and a doctoral degree is expected. Another project has produced a doctorate. In one study, the research project has been utilised in teaching activities for university students. In 13 out of 16 cases, the project has not been ambitious enough to include researcher training. One project has produced an MSc thesis and another project has contributed to postdoctoral training and knowledge building.

**B. Societal relevance and gain in the thematic area of Economy and market-related research**

*1. Has the research been attributed to important and up-to-date issues for Swedish and Nordic agriculture?*

The projects have a good record regarding relevance. Evaluation scores of 4 and 5 are justified in 11 out of 16 studies. Some projects have extended the traditional aspects covered: Some highly relevant points of view, such as consumer preference and changing global food markets are highlighted in some studies.

The need for new know-how is unquestionable in the areas under evaluation. The evaluated projects present a rich and colourful set of different orientations. The projects have been working in a very important field for the farming and horticultural society. There were three or four excellent and top quality projects. These projects have made a valuable contribution to international publication forums and in international researcher communities. Most of the evaluated projects address an important economic question that is relevant for farmers and entrepreneurs. Most of the work has been focused and oriented to finding a solution to a concrete problem. Some of the projects give clear recommendations for actors, including policy designers.

In the future, more emphasis should be put on the sustainability of food products and food chains. The environmental and consumer point of view should be strengthened. The requirements faced by the food chain relate especially to environmental impacts and the transparency and sustainability of animal production.

*2. Has the research been attributed to important conditions for sustainable development (in its different dimensions) of Swedish and Nordic agriculture?*

One-half of the projects are probably doing well in developing conditions for sustainable development. There is at least a lot of potential. In the other half of the projects the positive impacts on development are not so very obvious, or such impacts are not reported well.

*3. Has the research produced new and important knowledge that is possible to use in a reasonable time-frame?*

One-third of the projects have a good performance in this aspect (evaluation score of 4). The know-how to react to the changing markets is valuable to the actors. In one-half of the projects, the stage is too early to judge. For four projects, the potential is not reported.

Many projects suffer from short durations and low budgets. They are merely pilot-studies that provide a starting point for a more detailed analysis. In the second phase, the theoretical value of these projects may be increased. The value of these projects was, nevertheless, in the solving of practical management problems, which may have significant value as such for society. They have provided information for topical and pragmatic decision problems, but have not been ambitious or analytical enough for building new knowledge. Because of the low budget costs the projects may unfortunately not contribute much in developing the Swedish agri-food sector. The descriptive information provided by the projects is valuable, but one might expect a more analytical approach to generate new information and to really contribute in developing the Swedish food sector.

*4. Has the research and its results been communicated to advisors and farmers to a satisfactory extent?*

One quarter of the projects have shown good performance in this aspect, i.e. researchers have been active towards major reference groups and also in the media (evaluation score of 4). One quarter of the projects did not report on this aspect at all. One half of the projects have indicated some activity, but not nearly enough (evaluation scores of 2 and 3). In general, better performance in the communication and dissemination aspect is required.

## **Working environment-related research**

The working environment-related research has been focused on health aspects in animal production and broader studies of accidents and work related diseases in agriculture. Problem areas such as gas exposure, dust and noise have been studied, and medicine studies in pig production have identified some severe risks to health if no preventive action is taken. Furthermore, the benefits of automation in animal production methods have been studied. The studies show that production systems based on new technology can reduce the risks to human health in ergonomic and respiratory aspects. Some pilot studies of the statistics of farm accidents and diseases have tried to identify the main problems in the working environment in agriculture. The results can be used to make relevant decisions on the priority of further actions and projects.

Summaries of the data and evaluation scores for this thematic field are provided in Table 7 and Appendix 4, respectively.

### **A. Scientific quality in the thematic area of Working environment-related research**

#### *1. Has there been a clear scientific rationale for the research?*

One third of the projects can be evaluated as top quality research (evaluation scores of 4–5). These projects have strong connections with animal husbandry and human medicine issues. One quarter of the projects have more pre-study or practical orientation with limited scientific ambitions and evaluation scores of 0–2.

#### *2. Have methods used been appropriate and up-to-date?*

In one third of the projects the methods have been very good or excellent (evaluation scores of 4–5).

#### *3. Have the projects been led by people with sufficient academic merit?*

In three quarters of the projects the leadership is valued as good, very good or excellent (evaluation scores of 3–5).

#### *4. Has the scientific production in the form of international peer-reviewed articles been quantitatively and qualitatively satisfactory?*

In one third of the projects peer reviewed journal articles have been published or are under publication. In some of the projects the evaluation indicates the potential for publication,

Table 7. Summary of project data for the thematic field of Working environment-related research.

Property	All reported projects	Projects with final year 2007 and earlier		Projects with final year after 2007	
		Small	Large	Small	Large
Proportion of projects in relation to final year and size (%)	100	50.0	7.1	28.6	14.3
Proportion of projects having cooperation (steering/ref group) with other organisations (%)	64	43	100	75	100
SLF-funding (MSEK)	8	3.3	1.6	1.5	1.7
SLF-funding, mean per project (MSEK)	0.57	0.46	1.55	0.38	0.87
SLF's share of funding (%)	94.9	100.0	100.0	92.0	85.3
Number of peer-reviewed 0.4 articles per project	0.6	1.0	0.0	0.0	
Number of peer-reviewed articles per MSEK*	0.66	1.30	0.65	0.0	0.0
Proportion of projects appearing on scientific conferences (%)	57.1	100.0	100.0	0.0	0.0
Proportion of projects with international scientific co-operation (%)	7.1	14.3	0.0	0.0	0.0
Proportion of projects with national scientific co-operation (%)	35.7	14.3	100.0	25.0	100.0
Proportion of projects contributing to university education (%)	42.9	42.9	100.0	0.0	100.0
Number of popular publications per project	0.4	0.6	1.0	0.0	0.5
Number of popular publications per (MSEK)	0.71	1.23	0.65	0.00	0.49

\* MSEK total funding (SLF + other)

but the project stage is too early in respect to the project timetables.

### *5. Has the research been visible enough at international conferences?*

In 3 out of 13 projects, the results have been presented at more than one international conference. Five more projects have produced one conference presentation each.

### *6. Has the research to a reasonable extent used obvious possibilities for national and international cooperation?*

In one third of the projects, there has been scientific collaboration in various fields but there is a lack of emphasis on collaboration in the international arena. Just one project has reported international collaboration. National cooperation is more common with a focus on popular arenas.

*7. Has the research contributed to the education of the next generation of scientists by opening projects for students at different levels (MSc, Lic, Dr)?*

One study has already produced a doctorate degree. Three doctorate degrees are expected, two of them in 2009. In five projects, the study has been utilised in teaching activities for university students. One project produced a thesis at MSc-level. Many projects have low scores or no reported activities in this aspect.

**B. Societal relevance and gain in the thematic area of Working environment-related research**

*1. Has the research been attributed to important and up-to-date issues for Swedish and Nordic agriculture?*

The studies have a good record in this respect. Five projects have reached an evaluation score of 4 and the rest an evaluation score of 3. The research has a high relevance and deals with problems that are crucial for the working environment on the farms. Air quality in animal production and noise are focused on in several studies. Ergonomic and accident report studies also have high relevance.

The evaluated 13 projects have been working in a very important field for the farming society. The need for new know-how is unquestionable in a business with so many risk moments and high percentages of accidents in comparison to other business areas. Swedish research can be leading if the strengths are used accurately. Among the evaluated projects there are some that present an interesting combination of innovative research topics and excellent quality. Animal and human welfare will go hand in hand if the results can be transformed into new solutions and changed behaviour. Linking different disciplines and different research institutions is fruitful. One example could be when medical and animal welfare research gets help from the advanced sensor technology area to monitor and manage systems in new ways. Internationally these combinations can be success stories and contribute to sustainable development in all aspects.

*2. Has the research been attributed to important conditions for sustainable development (in its different dimensions) of Swedish and Nordic agriculture?*

Many projects have implications for sustainability and have high scoring. Seven studies out of 13 have an evaluation score of 4–5. Many studies focus on health aspects, whereas the



economic impact and environmental aspects are not communicated as much, although they can be very important.

*3. Has the research produced new and important knowledge that is possible to use in a reasonable time-frame?*

One-third of the projects have a very good performance (evaluation score of 4). The combination of human medicine studies with the farm environment has good potential and can be used to increase the general know-how in that field. This has important links to animal welfare issues.

Working environment issues have been a focus in Sweden in recent years. The research undertaken provides an important contribution for providing a foundation and developing better methods and systems for improving working environments. Future wishes to validate different systems from a working environment point of view will be a mixture of technological, economic and biological/medical considerations. However, it is important to note that the process of changing a habit is a psychological process in which research and statistics are only a part of the ingredients. In the new concept “LOFT-farmer and scientists together” there is a good opportunity to be successful in the knowledge transfer process.

*4. Has the research and its results been communicated to advisors and farmers to a satisfactory extent?*

Two projects have had very good performances, i.e., the researchers have demonstrated activities towards major reference groups and also in the media (evaluation scores of 4). Most of the projects have communicated their results both through the media and via meetings, but the activity rate is generally not so high.

Knowledge transfer to and between farmers is always more likely to happen if there are some associations to technology and/or economy. The results are more interesting when translated to compatible effects on the farm or within the society. This is normally the role for the advisors but in the external communication there is not always advisory help. Most of the projects in this field, however, have high relevance so the end-users are normally familiar with the terminology and effects. More focus and continuity in the strategy, together with an open-minded cooperation with institutions, actors in Sweden and abroad, can create an even broader and brighter picture for the future.



# Strengths, weaknesses and future recommendations regarding scientific quality and relevance of research

The project portfolio revealed some clear strengths as well as some weaknesses common to all thematic areas evaluated. It should also be noted that in general, there is very large heterogeneity in the performance of projects within a given thematic area.

Relevance for sustainability issues has been identified by the Swedish Board of Agriculture as a key concept for the SLF funding. However, sustainability has not been clearly defined either in the documentation of the Swedish Board of Agriculture or by SLF. This may be one reason why the orientation and contribution of projects with regard to the sustainability objective of the funding varies significantly.

## **Strengths of the project portfolio**

- High relevance of research. In general, the topics seem to be well warranted and need-driven. The research topics are based on 'real' problems and potential opportunities in Swedish agriculture. Most of the projects are of an applied nature and have a strong link to practical problems.
- Even though in the minority, there are some top-quality projects that are strongly methodology-oriented, knowledge-building and at the same time relevant for the Swedish food-chain.
- Most of the projects seem to be based on solid and up-to-date methodologies.
- Some projects have developed excellent and efficient communication practices, which could serve as best practices for other projects.
- SLF funding seems to play a vital role for supporting applied research in some specific areas in the Swedish system, such as animal science and veterinary medicine. The applied nature of some of these topics would probably not have been funded by the more general research councils or funds.

## Weaknesses of the project portfolio

- There are many very small projects, and this has generally resulted in an overall fragmentation of the research and available resources. This severely hinders the impact of the research undertaken as well as the interdisciplinary approaches to be formed with this funding instrument. The mean SLF funding per project was only 0.84 MSEK, and with co-financing the mean total funding per project was 1.08 MSEK.
- Research involving experimental field work can be difficult to finalise within small, short-term projects with relatively small budgets. This poses severe difficulties in carrying out scientific work of an internationally high-standard.
- Too many projects do not deliver sufficient outputs. This is evident when evaluating the number of scientific peer reviewed articles, international and national research collaborations and communication, and various aspects of popular communications. The average number of peer reviewed publications is only 0.3 articles/project (0.29 articles /MSEK); the average number of popular publications is only 0.4 publications/project (0.39 popular publications per MSEK). It is essential that scientific publishing is encouraged, as it is a means of quality assurance in research: the methods used and outcomes obtained have to be tested and validated by submission of articles to peer reviewed journals, otherwise research results cannot be considered as results by scientific definition. In applied research, which aims to provide answers to practical problems, the validity of results is crucial due to the direct links to economic gains or losses when adopting the practices.
- The projects show relatively low performance in relation to communication and dissemination of results (knowledge transfer and exchange), with on average less than half of the projects showing activities. This seems to be in clear contradiction to SLF specific goal setting regarding the importance of communication. SLF evaluation criteria also include dissemination strategies. The proportion of projects appearing at scientific conferences is 39.5 per cent; the proportion of projects appearing on practice conferences is 50.8 per cent; the proportion of



projects with presentation on courses is 30.2 per cent; the proportion of projects with presentations in the field is 26.6 per cent; the proportion of projects in dialogue with practises is 48.8 per cent.

- The projects show a low level of international partnerships as the proportion of projects with international cooperation is only 29.4 per cent. There seems to be a potential for much stronger Nordic and international collaboration to enhance research capacity and output, as well as the dissemination of results obtained.

- The project portfolio reveals a rather low level of interdisciplinary research. A majority of the projects had not adopted an interdisciplinary approach where, for example, ecological and economical expertise was linked in the context of sustainability. However, interdisciplinary research could be of great importance when seeking sustainable solutions for Swedish agriculture.
- A surprisingly large proportion of projects did not implement student training at different levels, despite the fact that many of the projects were located at SLU (Swedish Agricultural University).

### **Recommendations regarding strengthening of scientific quality and relevance**

- In order to support projects with high impact it is strongly advised that funding should not be split up into such a high number of relatively small individual projects as has previously been the case. The Panel recommends that larger but fewer projects should be funded. This could perhaps also allow more interdisciplinary approaches to be implemented and would also secure proper outcomes from projects that carry out risky field experiments.
- Swedish farmers may not have an immediate interest in having research work published in international, scientific, peer reviewed journals. However, if scientific publishing was established as an important target of the work, planning of research as well as research results would meet scientific standards. It is strongly recommended that more emphasis should be put on the generation of deliverables in the form of scientific, peer reviewed papers, as this form of dissemination will ensure that data and results are not lost over time, and that they also have an impact in the international community as a way to also increase collaboration with international colleagues. Many projects have a good potential for international publication, even though this has not often been fully implemented. Furthermore, publishing in peer reviewed journals will be the only way forward if researchers are to attract more funding from e.g. the EU to support agricultural research. In this way, more focus on written output will create a positive 'spiral' for the benefit of researchers and farmers, as well as the international community. The Panel also recommends that SLF should develop a system

for collecting peer reviewed articles even after the final report is presented to SLF.

- Many of the projects show rather poor performance in the aspect of popular communication. It is strongly recommended that dissemination and communication plans should be emphasised and included as part of a proper project proposal. Furthermore, SLF should be active in disseminating such efficient communication practices as have been developed and tested in a context of individual successful projects.
- Applied research projects in the field of agriculture may often have an element of collaboration with the extension service. It is strongly recommended that researchers are required to make liaisons with local extension service officials and other key beneficiaries and end-users of research already in early planning stages and throughout the project period of their research. This could be in the form of active and constructive reference groups with broad representation.
- The Panel recommends that the final reports and other project publications are published on SLF homepages, with links to articles and other publications from the projects. The summary should also be provided in English to support international communication and collaborations.





# Recommendations regarding SLF program and process related issues

SLF has established procedures for managing the use of the funds originating from the redistribution of taxes on commercial fertilizers and pesticides. This relates to the whole process from initiating calls for proposals to following-up on projects.

Proposals are examined at SLF according to several criteria, including research topic, economic issues, material and methods, competence of applicant, dissemination strategy and relevance (see Appendix 3). The proposals are at first ranked according to rating of relevance for the farmers, and at the selection committee meetings the other criteria are also taken into account before the final decision.

SLF's selection/ grant awarding committee members are, with very few exceptions, from the Swedish agricultural sector and are Swedish researchers. Very few, if any, Nordic or international members are involved in the selection committees. Furthermore, it appears that there are no committee members outside the agricultural sector representing consumers or taxpayers, or other sectors such as industry or environmental organisations. Currently, the SLF selection committees have been nominated for topical areas such as working environment, bioenergy, meat, milk, potato, poultry, sugar, entrepreneurship, horticulture, plant production, improvement of methods and technologies, phosphorus research, committee on horses, and so on.

The Panel recommends that the memberships in the grant awarding committee structure should be revised so that 50 per cent of committee members are currently active researchers and the other 50 per cent are farmers' representatives and consumer representatives etc. It is envisaged that Nordic/ international experts should be part of the committee, or there should at least be a review process for grant proposal calls involving Nordic/ international experts.

SLF program grant proposal calls (see Appendix 2) have been based on the wishes of the farmers' organisations, and these have resulted in unique but rather diffuse and detailed call texts, where the overall aim and goal of the projects have not been clearly presented. Starting from the year 2005 and onwards, the grant proposal calls have been very detailed, with the funding resources being split up into various areas of crop and animal production. This could severely hinder an innovative and integrative process when formulating the project applications and also hinder the development of project plans with a more interdisciplinary approach. The priority areas seem to be formulated without any prior notice to international or Nordic state-of-the-art within the different research areas. However, the milk programme has developed an organised structure for cooperation between Sweden and Denmark.

SLF program grant proposal calls have emphasised sustainable development, but without any clear definitions of the meaning of this term, except that it should be ecologically, economically and socially based.

The success rate for a research proposal in an SLF call is around 30 per cent, which in comparison to success rates of research grant proposal calls in general indicates a low competition level. The SLF-funded mean project funding has been 0.84 MSEK and a total of 1.08 MSEK when co-funding is included. This is a rather small funding amount for substantial research to be carried out. Overall it is not possible to make larger strategic advances with this amount of funding, but it should still be possible to carry out research that is both targeted at solving specific problems and analysing new possibilities for Swedish agriculture. However, it would be of key importance to develop a new strategic approach, which will also allow for larger and more long term projects including multiple location field trials over 3–4 years.

It would be strategically wise to actively seek different co-financing schemes, together with public and private financing. Currently, there are only a few co-financing schemes, since SLF's contribution to the total funding of projects under evaluation is as high as 85.6 per cent.

Other research and innovation financing organisations in the Swedish system such as Formas, Swedish Research Council, science academies, VINNOVA, private foundations and

companies could be potential future partners for joint co-financing partnerships and new strategic initiatives within the areas of natural resources management and sustainable agriculture. With some of these organisations, SLF has already gained experiences of co-financed programmes.

The Panel identified the following issues to be of importance for revising in the current SLF program and process related approach:

- The sustainability concept is not sufficiently either defined or stressed in texts from the Swedish Board of Agriculture (SJV) and SLF.
- SLF should work in a more programmatic way with a broader scope of the calls for proposals facilitating interdisciplinary approaches. In the current state, the themes per proposal call are too many and too fragmented, having many negative implications on the impact of this SLF-funding instrument.
- SLF should have fewer – preferably only one – grant awarding/ selection committee.
- More international members in the grant awarding committee could improve quality in the selection process.
- Call for proposals texts could preferably also be announced in English, so facilitating international collaboration.
- SLF should pay more attention to scientific quality, as this is the provisional quality control needed for all research regardless of type, whether basic or applied.
- SLF should also give clear incentives and expectations for peer reviewed and other types of publications.
- Scientific quality and relevance could perhaps be better judged in separate but parallel initial processes.
- There is no obvious description indicating a focus on gender-related aspects in the program proposal call texts and/or evaluation panels. However, it could be emphasised in the call texts/and grant awarding committee evaluations that both male and female scientists are encouraged to apply.

## **Key recommendations for program and process related issues**

- Many issues seem to be too small to warrant all the detailed and distinct calls for proposals that SLF has announced during the years 2002–2007. In mid-2007, the board of SLF decided to have only one major call for new projects per year. It is recommended this practice should be fully adopted so that the proposal calls are streamlined and coordinated into one call each year. The coordination of calls for proposals makes it more attractive and easier for researchers to get an overview of the themes of the grant calls. This may again attract more grant applications, thereby creating more competition between applicants, which again may lead to a higher quality of grant-funded project activities.
- The calls for proposals should be formulated in a way that stimulates more interdisciplinary work.
- It is recommended that the grant proposal calls focus more on national and international collaborations.
- SLF should be active in developing new national and international co-financing schemes, especially for broad interdisciplinary research areas.
- SLF should further develop its material on the web pages to be more informative regarding research funding and procedures. The information currently appears to be a bit 'implicit' for researchers who are already familiar with the system, but more difficult to comprehend for newcomers.
- It is recommended that all call for proposal texts should also be provided in English as this may encourage more international collaboration. Submission should also be allowed in English.
- It is recommended that SLF should further develop the format for the submission of research project proposals. The format should include a minimum of the following: 1) project background, 2) state of the art in the subject to be studied, 3) aim of the project, 4) description of collaborators and their expertise and contribution, 5) materials and methods, 6) research activities with time

plan and budget plan, 7) communication plan, and 8) description of deliverables, such as international and other publications, to ensure that researchers have some reflections and ideas about this aspect already at the time of submission.

- During the selection procedure, it is strongly recommended that a clear distinction be made between evaluating research quality and relevance. Researchers should evaluate and ensure high scientific standards, and the beneficiaries/ end-users should evaluate the relevance of the proposals. There should be a transparent procedure that would ensure that scientifically poor proposals cannot obtain funded, even if their topics are of high relevance.
- It is strongly recommended that the selection/grant awarding committees should be only a few (1–2) in number, preferably only one committee that would also be much more homogenous in respect to representation of researcher and stakeholder representatives. It is also advised that SLF could use international scientific experts for the evaluation process. Having only one selection committee would allow more programmatic approaches in research funding, it would encourage interdisciplinary approaches and broader discussion on the future needs and potential of Swedish agriculture and agricultural research, as well as create more transparency and visibility in the process and flexibility in directing the limited funding resources. There is clearly an urgent need to develop the selection process towards supporting interdisciplinary and larger projects and to avoid fragmentation and narrow disciplinary work with very low innovative value.



# Future opportunities and main conclusions

Swedish research can be leading in the area of agriculture and sustainability if current strengths are identified, strategic choices in developing funding schemes are made by different financiers, and emerging key research lines are supported accordingly.

There is a need for closer interaction between end-users and researchers, not only to strengthen the knowledge transfer to the agriculture sector but also to facilitate a two-way dialogue that can give rise to and formulate new questions and develop new research directions. SLF is in a unique position to enhance that dialogue with a wide network in the sector. Linking different disciplines and different research institutions to join their capacities for sustainable agriculture and management of natural resources can be very fruitful and can contribute to building new competence in the sector.

Some research areas of potential interest for Swedish agriculture in the future can be envisioned. They may include, amongst others, adaptation of agricultural production to changing climate and environments. With climate change there is a need to study the production of new, alternative crops, their potential under Swedish conditions, and agricultural economics in alternative production scenarios. The climate change issue also stresses the need to study new and emerging disease and pest problems, which may become production constraints in the future. Latest advancements in molecular biology and biotechnology should be of significance here.

Animal based production is currently changing dramatically, both in Sweden and globally, due to new technical possibilities, new expectations from society and changes in production conditions such as changes in climate and biosecurity. Potential new lines of research relate to emerging infections in relation to climate changes; housing systems fitting current and future livestock production, and neonatal diseases and mortality in production animals. Sustainability and welfare issues in animal production in Swedish agriculture will also require significant research input.

Research in the area of ecosystem services involves complex tasks and different disciplines. By linking biology to technology and economy in a sustainability context the research can contribute to long term welfare and innovative production systems. Finding new ways to optimize productivity is a challenging research area.

Furthermore, research on precision farming, soil processes and nutrient dynamics has a lot of potential for the advancement of Swedish agriculture in the future. Linking new ICT technologies to sustainable production and processing, as well as to risk management and traceability in the whole food chain, is a promising research area. Linking to economic approaches would promote new lines of business development in this research area.

All of the above mentioned research fields are interdisciplinary in nature, have great significance for developing sustainability in agricultural production, and have a lot of potential for international research collaborations.

In view of the policy of the Swedish Government to encourage sustainable development in agriculture and to decrease environmental impacts related to agricultural production, the Panel recommends that SLF should focus on supporting high quality interdisciplinary projects that aim to solve the challenges of sustainable production. Possibilities for new co-funding schemes with other financing agencies should be considered. A broader funding base would allow sufficient financing for research topics of high relevance. The societal impact of research could be improved by seeking efficient ways to disseminate research results to the scientific community, end users and the general public, by establishing active national and international collaboration and by targeting the training of students and the next generation of scientists.

As the main conclusions of the evaluation of the SLF-funded research, the Panel's recommendations are:

1. That larger but fewer projects are funded to avoid fragmentation of the funding into relatively low-impact small projects.
2. That SLF should be active in developing new national and international co-financing schemes, especially for interdisciplinary research areas.



3. That more emphasis is put on the generation of deliverables in the form of scientific, peer reviewed papers.
4. That detailed dissemination and communication plans with milestones should always be included as part of a project proposal.
5. That researchers are encouraged to actively liaise with local extension service officials and other key beneficiaries and end-users of research, starting already during the early planning stages of the project.
6. That SLF further develops the format for the submission of research projects and fully adopts the practice that the calls for proposals are streamlined and coordinated into one proposal call each year. The calls should be formulated in a way that stimulates more interdisciplinary work and have a focus on wider national and international collaboration.
7. That all proposal call texts are also provided in English, as this may encourage more international collaboration. Submission should also be allowed in English.
8. That the current selection procedure is improved so that there are clear criteria for evaluating 1) firstly research quality and 2) secondly the relevance of projects. Researchers should evaluate and ensure high scientific standards and the beneficiaries/ end-users should evaluate the relevance of the proposals.
9. That the selection/ grant awarding committees are only a few (1–2) in number, preferably only one committee that would also be much more homogenous in respect to representation of researcher and stakeholder representatives. It is also advised that SLF could use international scientific experts for the evaluation process.
10. That information about final reports and other project publications should be announced on SLF homepages. An English summary of the final report should also be provided.

# Appendices

Appendix 1. General information of the reported SLF-funded project portfolio in 2002–2007

Appendix 2. Summary of calls for proposals 2002–2007

Appendix 3. SLF's assessment of applications

Appendix 4. Evaluation scores for all projects and thematic areas

# Appendix 1

## General information about the reported SLF-funded project portfolio in 2002–2007.

Property	All reported projects	Projects with final year 2007 and earlier		Projects with final year after 2007	
		Small	Large	Small	Large
Proportion of projects in relation to final year and size (%)	100	28.6	18.1	20.2	33.1
Proportion of projects having cooperation (steering/ref group) with other organisations (%)	69	68	62	62	77
SLF-funding (MSEK)	208	25.9	54.5	21.1	106.7
SLF-funding, mean per project (MSEK)	0.84	0.36	1.21	0.42	1.30
Total funding incl co-funding (MSEK)	267	28	65	23	151
Total funding, mean per project (MSEK)	1.08	0.39	1.44	0.45	1.85
SLF's share of funding (%)	78.1	93.8	84.0	93.1	70.4

Type of project*	All reported projects	projects with final year 2007 and before		Projects with final year after 2007	
		Small	Large	Small	Large
Applied research	177	44	37	35	61
Development work	29	9	4	7	9
Trials (practical exp:s)	17	9	1	2	5
Information etc	9	3	0	4	2
Other	16	6	3	2	5
<b>Total</b>	<b>248</b>	<b>71</b>	<b>45</b>	<b>50</b>	<b>82</b>

\*According to the project leaders (rapporteurs) own opinions

Publications and activities	All reported projects	Projects with final year 2007 or earlier		Projects with final year after 2007	
		Small	Large	Small	Large
<b>Scientific activities</b>					
Number of peer-reviewed articles per project	0.3	0.3	0.6	0.1	0.3
Number of peer-reviewed articles per project SD	1.00	0.48	0.55	0.14	0.71
Number of peer-reviewed articles per MSEK*	0.29	0.77	0.41	0.22	0.16
Proportion of projects appearing on scientific conferences (%)	39.5	39.4	57.8	18.0	42.7
Proportion of projects with international scientific cooperation (%)	29.4	29.6	42.2	14.0	31.7
Proportion of projects with national scientific cooperation (%)	43.5	35.2	62.2	26.0	51.2
Proportion of projects contributing to university education (%)	54.8	49.3	62.2	38.0	65.9
<b>Practice-related activities</b>					
Number of patents	3				3
Proportion of projects appearing at practice conferences (%)	50.8	54.9	77.8	30.0	45.1
Proportion of projects with presentations on courses (%)	30.2	38.0	37.8	18.0	26.8
Proportion of projects with presentations during field trips, study trips etc (%)	26.6	26.8	42.2	16.0	24.4
Proportion of projects in dialogue with practice through reference groups, radio, TV (%)	48.8	47.9	55.6	36.0	53.7
Proportion of projects with popular publication (%)	39.1	45.1	57.8	16.0	37.8
Number of popular publications per project	0.4	0.5	0.6	0.2	0.4
Number of popular publications per MSEK*	0.36	1.16	0.40	0.35	0.20

\* MSEK total funding (SLF + other)

# Appendix 2

## Summary of calls for proposals 2002–2007

The table presents available funds (MSEK) including both redistributed tax money as well as money from the farmers. The parts that relate to tax money are presented in parenthesis. The calls for proposals include a presentation of each area, and money available, as well as a detailed description of the R&D programmes. In some cases the redistributed tax money has been distributed by SLF over several years.

Call (Oct 1 and Feb 1)*	2002	2003	2004	2005	2006	2007	Total Farmers + Tax	Total Tax	Share Taxes (%)
<b>Research year</b> (for 3 yr projects)	2002–4	2003–5	2004–6	2005–7	2006–8	2007–9			
<b>R&amp;D area</b>	<b>MSEK</b>								
Plant production	19.5	21.1	11.7 (3.0)	19.5 (10.0)	18.2 (8.0)	19.4 (16.0)	109	37	34
Field trials	0	0	0	0	(3.0)	(10.0)	13	13	100
Milk	11.5	10.2	19.8 (3.0)	16.8 (2.0)	10.4 (3.0)	17.2 (8.0)	86	16	19
Meat	2.6	10.6	3.7 (3.0)	8.3 (3.2)	10.5 (5.0)	10.8 (5.0)	47	16	34
Poultry	1.5	2.9	0.4	3.9 (0.15)	2.9 (1.0)	2.6 (1.0)	14	2	14
Sugar	13.5	13.2	2.2	(4.0)	4.3 (4.0)	6.3 (4.0)	44	12	27
Potato	3.1	4.9	1.5	7.6 (3.0)	5.4 (3.0)	7.8 (7.0)	30	13	43
Horticulture	(13.0)	(8.0)	(8.0)	(7.4)	(9.0)	(8.0)	53	53	100
Working environ.	6.6	5.3	6.0	4.1 (2.0)	8.7 (3.0)	5.6 (2.0)	36	7	19
Plant breeding	7.0	7.0	7.0	(6.0)	(6.0)	(6.0)	39	18	46
Entrepreneurship/ economy	0	10.0	9.7 (3.0)	9.9 (7.0)	13.1 (8.0)	24.6 (8.0)	67	26	39
Bioenergy				0	15.4 (4.0)	(5.0)	20	9	45
Plant nutrition and pest	(12.0)	(5.0)	(9.0)	(7.0)	(12.6)	0	46	46	100
<b>Total farmer + tax</b>	<b>90</b>	<b>98</b>	<b>79</b>	<b>94</b>	<b>120</b>	<b>123</b>	<b>604</b>		
<b>Total tax</b>	<b>25</b>	<b>13</b>	<b>29</b>	<b>52</b>	<b>70</b>	<b>80</b>		<b>269</b>	
<b>Proportion of taxes (%)</b>									<b>45</b>

\* In March 2007 the board of SLF decided that only one main call will be carried through in October each year.

# Appendix 3

## **Assessment of applications**

### **New projects**

For every new project application, the SLF office appoints a case assessor to draft a proposal for a statement on the application and to recommend a decision. Those appointed as case assessors are researchers or professionals. Within the R&D programmes Horticulture and Growth & Business, an additional member is appointed to assess the relevance of the project for the agricultural industry. In the remainder of this document, this individual is referred to as the relevance assessor. If the assessors appointed consider themselves to have a conflict of interests, the SLF office must be informed of this immediately so that a new assessor can be appointed. Conflicts of interest are recorded in the application system by members themselves for the actual projects.

### *Working procedure for all members*

All members of the Deciding Group must read through all projects, make an assessment and allocate points based on the criteria given below. Note whether the project is specified as a research project or a development project, as these must be assessed on the basis of different criteria (see below). All applications are entered into our computer system and assessments of applications must be uploaded to address <http://ansok.net/slf/opinion>. Conflicts of interest are also recorded in the system. To enter the system members must use their personal code, which is attached to the applications. This code must also be used by members when continuously assessing final reports in the system. It is therefore very important that members save their code.

Points allocation and conclusions on each project must be entered by the date specified on the commission at the latest. After the system is closed it is not possible to enter additional information. On the day after closing it is possible for members to enter the system and retrieve the combined assessment of the Group under the heading 'Show Group Assessment'. This combined assessment is also handed out at the decision meeting.

The relevance for the farmers is highly important. Therefore, the combined assessment list is organised according to relevance. However, the scientific quality is carefully taken into account when doing the evaluation (see below), i.e. high relevance projects are not necessarily awarded funding, and vice versa. Note that from 1 October 2008, projects where the applicant did not complete a previous project within the appointed time will not be awarded funding for new projects. Applicants have the opportunity to apply for a postponement of final reporting in special circumstances.

#### *Working procedure for case assessor members*

1. The case assessor reads all new applications and allocates points according to the assessment criteria below.
2. The case assessor reads the applications for which he/she has been appointed case assessor and makes a careful assessment.
3. The case assessor draws up a proposal for a statement which is entered into the application system. The criteria used as a basis for allocating points should be employed as an aid in formulating the statement. The need for any coordination with other researchers and/or funding bodies should also be noted. The case assessor also draws up a proposal for a final decision (rejection or approval) that contains proposals on the amount to be granted, the running time of the project and any other revisions to the project. The text for rejection must be based on the content of the criteria and the figures (see below).

The relevance assessor (Horticulture and Growth/Business) makes an assessment of the relevance to industry and e-mails this assessment to [charlotte.ericsson-ds@lrf.se](mailto:charlotte.ericsson-ds@lrf.se)

4. At the meeting, the case assessor and relevance assessor present the projects for which they are responsible. The case assessor pays particular attention to what is said and decided regarding the actual projects.
5. If the group decides to grant funding, this is recorded by the secretary.
6. If the group decides to grant funding but of a reduced amount, the reason for this must be clearly described. If the project is granted funding but on specific conditions,

this must also be clearly described. The description of specific conditions must always conclude with: 'Conditions must be submitted to the SLF office together with the signed contract. Funding will not be paid until the conditions are fulfilled.' The conditions are formulated by the case assessor but followed up by the secretary.

7. If the group decides to grant funding and wishes to provide information to the researcher, this is formulated by the case assessor.
8. If the group decides to reject the project, the case assessor formulates a rejection statement. This statement must take account of the comments made in the statement and at the meeting. The statement must be formulated so that the researcher clearly understands the reason for the rejection. Positive feedback can also be given. The text on rejection must be based on the criteria specified and the points allocation (see below) and comprise at most 10 sentences.

Rejection statements, conditions and information to researchers are to be e-mailed to the secretary for the group within 3 working days of the meeting.

### **Ongoing projects**

For ongoing projects, the same case assessor who originally assessed the application is appointed. If this previous assessor is no longer a member, he/she is replaced by a new case assessor. The case assessor must read through and assess whether the project is proceeding according to plan. The planning framework and any other information are specified for the respective project on the project list, which is sent out together with the application documents according to the following:

*Amount in italics* = Granted previous year.

**Amount in bold** = Framework funding according to current round of applications.

Amount in normal font = Framework funding in coming round/s of applications.

If members need to access the original application, it can be retrieved from the application system during the actual round of applications.



If the Group decides to grant continued funding for a project according to the planning framework without any conditions, no information is given to the researcher. If the funding is conditional, the conditions are formulated by the secretary.

*If you have any questions about working in the system, you can call Charlotte Ericsson, SLF, on telephone 08-787 53 95. For technical support contact Orbelon on telephone 08-500 022 25 during office hours 8.00–17.00. For other questions, contact the respective research secretary.*

## **Criteria for assessing research projects and development projects**

### *Definitions of applied research and development*

Applied research – is based on a theory and has a specific application in view (can be both short-term and long-term).

Development – uses previous research results and scientific knowledge to create new areas of application.

SLF and SLUT grant funding to both applied research and development. To clarify how projects within these two areas should be assessed, different criteria have been drawn up. The points range given after each criterion is used in the assessment. These points have the following meaning:

- 1 – Unacceptable
- 2 – Needs improvement
- 3 – Satisfactory
- 4 – Good
- 5 – Very good
- 6 – Excellent

### **Research projects**

#### *Research issue (1-6)*

- Is the area of the application well described?
- Is the literature well reviewed?
- Have the issue, hypotheses and clear objectives been formulated?
- Have orienteering studies been carried out and have these been considered in formulation of the research issue?

#### *Materials and methods (1-6)*

- Are the materials and methods well chosen with regard to the research issue?

- Does the structure allow for reasonable statistical analysis and for the questions raised to be answered?
- Is there scope for involvement by industry?

#### *Expertise (1–6)*

- Is the expertise of the applicant, co-applicant/s and research group well described?
- Have the applicant and co-applicant/s the appropriate qualifications to carry out the project?
- Have the applicant/s and their research group published work of good quality within the area of the application or closely related area?
- Is the research going to be carried out in an environment where the research group can receive expert help from their surroundings?

#### *Cost calculations (1–3)*

- Are the costs clearly reported?
- Are the cost items of a reasonable size in relation to execution of the project?
- Has the OH supplement been correctly calculated, i.e. 25 per cent of the amount applied for?

#### *Degree of priority (1–6)*

- Is the research issue in the application well connected to the priority aims of the programme?
- Are there prospects of marked improvements for industry?
- Is the project sustainable and ethically correct?
- Has the project news value for industry?

#### *Communication of results (1–6)*

- Is there a clear plan for effective ways to report to the target groups concerned?
- Are journals, series of reports, websites, seminars, etc. well chosen for communication of the actual results?
- Is there a suitable reference group associated with the project?

### **Development projects**

#### *Research issue (1–6)*

- Is the area of the application well described?
- Has previous work been well reviewed and evaluated?
- Have the issue and objectives been well justified and well formulated?

### *Materials and methods (1–6)*

- Are the materials and methods well chosen with regard to the research issue?
- Does the structure allow for reasonable statistical analysis and for the questions raised to be answered?
- Is there scope for involvement by industry?

### *Expertise (1–6)*

- Is the expertise adequate and suitable for the proposed project?

### *Cost calculations (1–3)*

- Are the costs clearly reported?
- Are the cost items of a reasonable size in relation to the activities described and execution of the project?
- Has the OH supplement been correctly calculated, i.e. 25 per cent of the amount applied for?

### *Degree of priority (1–6)*

- Is the research issue in the application well connected to the priority aims of the programme?
- Are there prospects of marked improvements for industry?
- Is the project sustainable and ethically correct?
- Has the project news value for industry?

### *Communication of results (1–6)*

- Is there a clear plan for effective ways to report to the target groups concerned?
- Is there a suitable reference group associated with the project?

# Appendix 4

## Evaluation scores for all projects and thematic areas

### Evaluation scores for all projects and by main-field (Mean and SD)

Zero values (i.e. "not possible to judge") are not included in the calculations

Field	n	A. Scientific quality (grade 0–5)					Articles	Conf:s
		Scientific rationale	Methods	Competence PIs				
<b>All projects</b>	244	mean 3.69 SD 0.78	3.52 0.82	3.78 0.88	2.77 1.17	2.80 1.10	2.89 1.08	
<b>Crops and plants agriculture</b>	58	mean 3.80 SD 0.73	3.61 0.78	3.85 0.86	2.54 1.08	2.62 1.16	2.68 1.31	
<b>Domestic animals</b>	43	mean 3.43 SD 0.66	3.34 0.64	3.57 0.84	3.07 0.88	3.00 0.77	3.24 0.72	
<b>Economy and market</b>	17	mean 3.75 SD 1.25	2.40 1.26	3.31 1.32	2.30 1.57	2.17 1.47	2.96 1.05	
<b>Horticulture</b>	35	mean 3.42 SD 0.66	3.65 0.66	3.76 0.82	3.14 1.08	3.27 0.94	3.15 0.92	
<b>Pesticides</b>	14	mean 4.07 SD 0.83	4.20 0.92	4.33 0.78	3.00 1.91	3.25 1.75	3.30 1.64	
<b>Plant nutrient turnover</b>	35	mean 3.94 SD 0.70	3.56 0.68	3.62 0.60	3.14 0.77	2.85 0.73	2.76 0.64	
<b>Working environment</b>	14	mean 3.50 SD 1.35	3.86 1.35	4.00 0.87	2.64 1.69	3.00 1.48	2.70 1.16	
<b>Remaining rest</b>	19	mean 3.80 SD 0.70	3.58 0.77	4.35 0.88	1.73 0.96	2.29 1.05	2.24 1.09	

B. Relevance and benefits (grade 0–5)							
National and internat cooper	Inclusion young scientist	Overall	Importance agricult	Importance sustain develop	Usable results	Communi-cation efforts	Overall
2.58 1.19	3.33 0.80	3.89 0.80	3.64 0.79	3.39 0.84	3.30 1.15	3.66 0.80	
2.20 1.13	3.22 0.85	3.79 0.80	3.53 0.77	3.20 0.97	3.28 1.18	3.47 0.88	
2.78 1.13	3.27 0.78	3.62 0.62	3.43 0.76	3.33 0.69	3.34 1.03	3.45 0.74	
2.33 1.73	3.17 1.17	3.77 1.07	3.67 1.03	3.26 0.93	2.79 0.98	3.55 1.00	
3.05 1.15	3.33 0.69	4.02 0.72	3.76 0.69	3.52 0.66	3.85 0.86	3.83 0.58	
3.33 1.97	3.71 0.76	4.33 0.59	4.07 0.73	3.64 0.84	3.56 1.31	3.88 0.86	
2.63 0.90	3.56 0.53	4.57 0.63	3.97 0.72	3.83 0.94	3.52 1.08	4.03 0.89	
3.00 1.58	3.30 1.42	3.50 0.93	3.54 0.98	3.41 0.80	2.95 0.89	3.74 0.56	
2.47 1.07	3.39 0.68	3.83 0.64	3.58 0.65	3.19 0.75	2.68 1.57	3.60 0.65	





Formas, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, is a governmental research-funding agency. Formas encourages and supports scientifically significant research related to sustainable development.



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