Midterm Status Report 2002 and Application for Continuation in 2003

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The Directorate for Food, Fisheries and Agro Business
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1. Research program

Research in organic farming 2000-2005 (DARCOF II)

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2. Project title and number

III.2 Economic analyses of the future development of organic farming
Effects at the field, farm, sector and macroeconomic levels

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3. Head of project

Research Director Søren Elkjær Frandsen,
Danish Research Institute of Food Economics (FOI)

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4. Participating institutes

Danish Research Institute of Food Economics (FOI)
Danish Institute of Agricultural Science, Department of Agricultural Engineering (DIAS-DAE)

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5. Other project staff

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6. Project period (month, year)

Start of project:	1. October 2000		
End of project:	1.	January	2004

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7. Midterm description of the project, its results and progress, and application for continuation in 2003

A. Project summary

A.1. Objectives

The objective of this research project is to analyse the future development of organic farming in Denmark from the field, farm, sector and macroeconomic perspectives. Emphasis will be placed on the economic impacts of a continued expansion of organic farming in Denmark taking into account the adjustment problems of converting conventional farming into organic farming. Part of the research will also be devoted to analysing the regional effects, the impact on various environmental indicators of organic farming as well as the economic effects of policy initiatives in general (i.e. changes in agricultural and environmental policies).

The research project is characterised by co-ordinated efforts from the field level to the farm, sector and macroeconomic levels. At the field and farm levels the project will focus on the specification of labour and machinery systems in organic farming. Furthermore, the implications for total production costs and cost structures for different farm types will be determined. Given these and existing data for cost structures in conventional and organic farming, existing farm, sector and macroeconomic models will be adjusted and extended to incorporate the information obtained through this research project. Key words for the research efforts are the analyses of barriers to entry, the effects of uncertainty with respect to future markets and prices for organic products, impacts of different policy initiatives as well as the dynamic processes of converting Danish conventional farming into organic farming.

A core activity of the project will be to undertake a number of illustrative scenarios describing the economic effects at the farm, sector and macroeconomic levels. The scenarios will be co-ordinated across all work packages. The scenarios will include both the construction of a baseline scenario describing possible perspectives for the future expansion of organic farming in Denmark as well as a number of policy, regulatory and technology scenarios.

The results of the research project will illustrate the impacts of different designs of agricultural and environmental policies on the agricultural sector in general and on organic farming in particular. Furthermore, the results from the field and farm level analyses can be used to support farmers in converting to organic farming and to develop organic production systems.

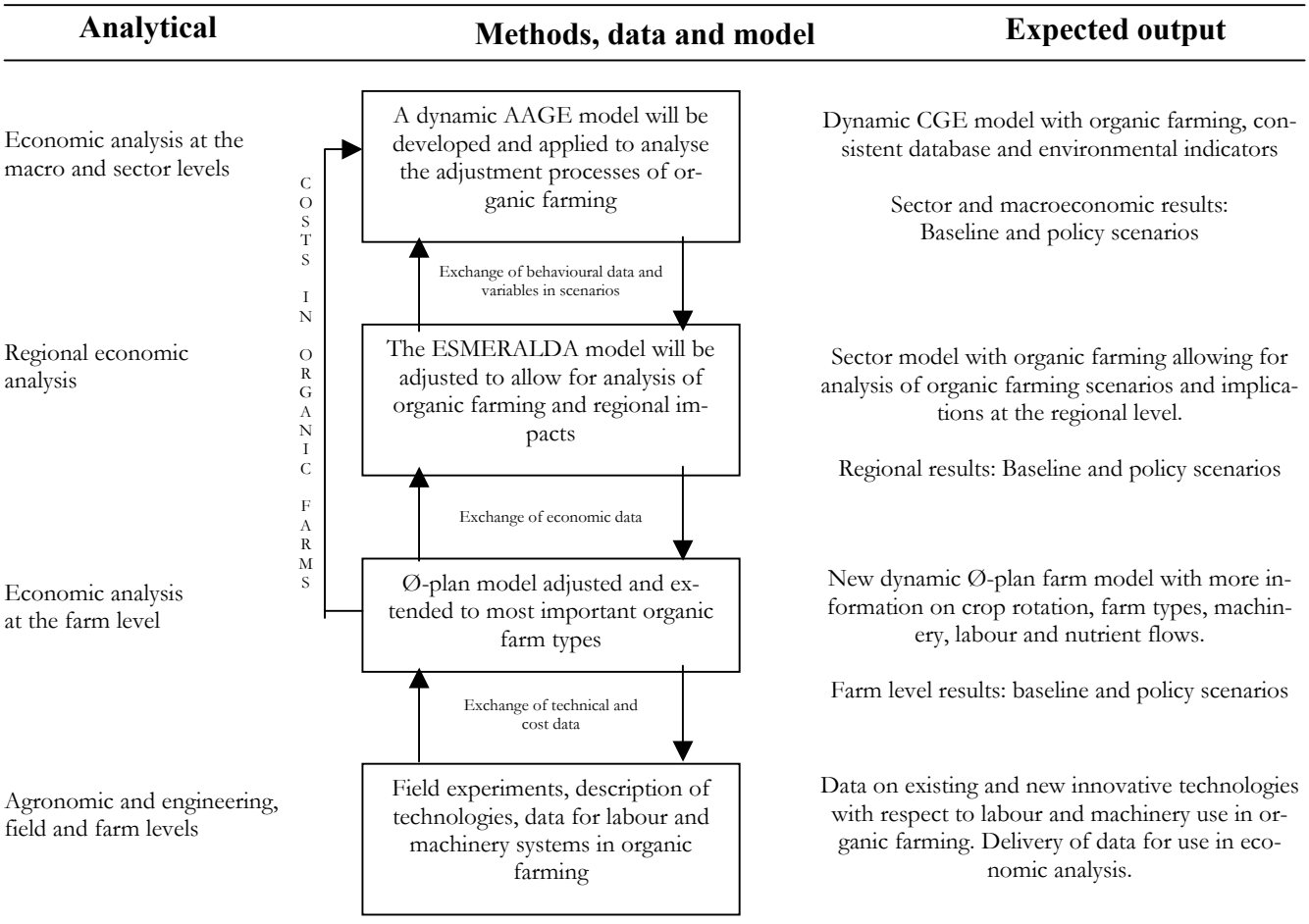
Finally, the results from the research project will be made available to the public through the FOI web site as well as through the publication of working papers, articles and research reports. Moreover, the research group is planning to arrange a final policy workshop with the objective of discussing methodology, data and policy implications.

A.2. Background and 'state of the art'

Previous research in organic farming in Denmark and the research undertaken under the auspices of the so-called Pesticide Committee (Bichel-udvalget) in 1998-1999 demonstrated the need for combining and strengthening agronomic and engineering insights with economic expertise allowing for a systematic approach to establishing a consistent analytical framework. The present research project draws on these earlier experiences and hence an overall research project in which both agronomic experts and micro and macro economic experts participate and co-ordinate their efforts. Furthermore, the project extends and improves already established databases and models at the farm, sector and macroeconomic levels. In this way, the project builds upon the expertise already established at the two research institutions, cf. for example the research projects 'Agriculture and Rural Districts: Economy and Development, 'Sustainable Strategies in Agriculture' and 'The Potential of Organic Farming in a Sustainable Development'.

Figure 1 illustrates the overall structure of the research project. The research project is divided into four analytical levels, ranging from research at the field level through the farm, regional and sector and macroeconomic levels. The project represents a unique integrated approach in the sense that the efforts are closely co-ordinated across the four analytical levels while at the same time the applied analytical methods differ reflecting their appropriateness for analysing the particular questions at hand at the different levels.

Figure 1. Overview of the research project



In particular, the previous research projects identified a number of areas in which new and intensified efforts are needed in order to analyse and evaluate the future development of organic farming in Denmark, namely to

- extend and improve the data on labour and machinery demand in organic farming (improving the field data),
- extend and improve the farm, sector and macroeconomic analytical framework, including extending the coverage to all major organic farm types and to enable an improved co-ordination with the agronomic and engineering knowledge (improving the technological, economic and environmental data),
- develop the theoretical and analytical methodology to take into account the dynamic processes of converting Danish Agriculture into organic farming,
- analyse the potential for extending organic farming practices in given regions or areas of Denmark

Table 1: Work package list

WP No	Work Package Title	Responsible participant	Budget, Mio. DKr.	Start	End	Deliverable No
1	Labour and machinery systems in organic farming	DIAS-DAE	1,400	1.10.2000	1.10.2003	1,2,3
2	Organic farming at the farm level. A study of the conversion process.	FOI-Farm	1,860	1.01.2001	1.10.2003	4,5,7,8
3	Economic Analysis of organic farming at the regional level	FOI-Policy	0,500	1.11.2001	1.07.2003	9,10
4	Development of a dynamic general equilibrium model with organic farming	FOI-Policy	0,935	1.01.2001	1.06.2002	11,12
5	Economic analysis of organic farming at the sector and macroeconomic level	FOI-Policy	0,935	1.06.2002	1.01.2004	13,15

B. Objectives and expected achievements

The objective of this research project is to analyse the future development of organic farming in Denmark from the field, farm, sector and macroeconomic perspectives. Emphasis will be placed on the economic impacts of a continued expansion of organic farming in Denmark taking into account the adjustment problems of converting conventional farming into organic farming. Part of the research will also be devoted to analysing the regional effects, the impact on various environmental indicators of organic farming as well as the economic effects of policy initiatives in general (i.e. changes in agricultural and environmental policies).

The major achievements will be:

- **Field and farm levels**: A description of the labour and machinery demand and costs involved in different organic lines of production dependent on different technological assumptions (existing and new innovative technologies).
- **Field and farm levels**: An analysis of the cost, direct energy use and impacts on environmental indicators of different organic production systems (existing and new innovative technologies).
- **Farm level**: Development of a farm model (Ø-plan) covering the most important organic farm types.
- **Sector and regional levels**: Adjustment of a sector econometric model ESMERALDA to describe and analyse organic farming at the regional level.
- **Sector and macroeconomic levels**: Development of a dynamic general equilibrium model for the Danish economy with organic farming included.
- **All levels**: Establishment of an overall consistent model structure – where consistency is established from the field to the farm, sector and macroeconomic level. Given the model structure the research team will be able - with relative short notice – to analyse the economic effects and impacts on environmental indicators of new policy initiatives.
- **All levels**: Construction of a consistent baseline scenario illustrating future developments of organic farming in Denmark dependent upon a number of different supply, demand and policy assumptions.
- **All levels**: Economic analyses of a large range of different agricultural, environmental, regulatory, and technology scenarios of which a number of scenarios will be co-ordinated across all five work packages.

C. Midterm results and progress

C.1 Description (summary) of main results and conclusions

WP1.

At the agronomic, engineering and field level the main results include extending and improving the data on labour and machinery demand in organic farming. Existing labour and machinery data has been reviewed and missing data and knowledge have been identified (Sørensen & Nielsen, 2002). Ways of acquiring missing information and data have been evaluated. The use of traditional labour studies have been discarded in favour of a questionnaire designed specifically for data acquisition on management tasks in various production systems (plant, cattle, and pig). In the same way, labour data on work operations in organic pig production has been collected in order to supplement existing data.

The preliminary results study shows that the management and monitoring tasks amounts to 12 – 22% of the total labour requirement, which seems to be comparable with the arbitrary addition of 15% for management tasks used for conventional farming operations. Also, the labour and technical investigation into the organic pig production has revealed that the work operations are implemented in a rational way. The layout seems to concentrate on having sows and piglets in out-door pens, while fattening pig are kept in-house with access to out-door areas.

Current as well as innovative technologies and work methods related to organic farming have been identified and evaluated (Sørensen, 2001). Technologies that are expected to be implemented in the next 5-10 years have been selected for further elaboration within the scope of case farms. As examples, the new technologies chosen consist of weed robot and milking robot aimed at reducing labour requirement. The technologies chosen will increase the capital invested, as it is assumed that a change towards more labour intensive farming is not likely. The selected technologies are either available or have been tested as a pilot technology, why they are probably available within the next 5-10 years. The investment cost and the likely yield effects using the new technologies are very uncertain.

A number of case farms (7), illustrating “future organic farms”, have been designed (se WP2). For these farms the analysis of the labour and machinery systems dependent on different technological assumptions (existing and new innovative technologies) have been initiated. At present all plant production and cattle farms have been analysed. The analysis comprises all work operations in the field and the animal houses together with a selection of machinery types and an estimation of machinery sizes. The analysis use prerequisites like cropping plan, an optimised animal manure application, norm yields adjusted to the cropping plan, etc. quantified by using the farm model Ø-plan. The output from the analysis, carried out by using the technical planning model DRIFT (Sørensen & Nielsen, 2002), comprises labour profiles, labour budgets related to the specific fields, to the specific crops, to the specific periods (week, months, etc.), to the specific machines or treatments, etc. For example, preliminary results show that the inclusion of row crops in the cropping plan demand a high labour input, which would reduce the uptake of row crops in the cropping plan. In terms of labour input, organic cattle production is comparable with conventional production.

WP2

At the farm level the extension of the Ø-plan model with more enterprises and more crops has been finished. With the addition of the Dairy production module to the existing toolbox consisting of organic pig, arable and poultry farms all the major production enterprises are now covered. The model is a spreadsheet model, which carries out economic calculations over a six-year conversion period. The concept and some results are presented in Tvedegaard, 2002.

The calculations are based on the recent changes within the sector including a) the milk price premium has been reduced to 15%, b) the 100% organic feed requirement have increased the feeding costs. The conclusion from the simulations is that the economic results on organic dairy farms with a livestock density under 1,25 LU (Livestock unit) per hectare are better than conventional farming, whereas the opposite is the case for farms with more than 1,25 LU per hectare. It is therefore not profitable for intensive dairy farms to convert to organic farming. Furthermore, the analysis shows that the drop in organic grain prices in 2002 by 20% increase the profit on dairy farms with a high stocking rate, which buy feedstuff and reduce the income on low stocking rate dairy farms which sell cash crops. The calculations from the model have also been used to assist the government in the considerations regarding a change in the structure of subsides for organic agriculture in Denmark.

The Ø-plan model has also been extended with labour data calculated on a monthly basis and work on implementing a machinery cost module is under way. This would allow for a choice between own machinery and contractors, where at present only the latter is possible. The work on including N- and P-surpluses in Ø-plan is under way and the preliminary results show that organic farms have a lower N-surplus per hectare compared to conventional farms with the same stocking density. Its found that the farming system is important as e.g. pig farms using deep litter systems have a larger N-surplus than systems based on slurry as the N-loss in both stable, storage and application is higher.

It was decided that the case farms should constitute the organic farms of the future. The analysis of the present trends have shown that: a) some organic dairy farmers with low productivity will leave farming as their income is declining; b) the number of conventional dairy farms converting to organic farming will be reduced to almost zero due to the high supply of milk compared to the demand; c) Farmers converting to organic farming will mainly consist of part time arable farmers and some pig farmers. d) the arable farms converting will become bigger. The farms converting to organic production used to be hobby farms of 5-10 ha, but they are now part time farms of 20-50 hectares (Kledal, 2001c).

The 7 case farms are constructed with these trends in mind and will be extended with the regional perspective on the conversion rate in order to support the analysis carried out in WP3. The 7 farms consist of 3 dairy farms, 3 arable farms and one pig farm (Kledal, 2001c). The farming systems are based on the current technology, which has been found in close cooperation with WP1 and through talks with local advisors in organic farming. The machinery costs on these farms is now being calculated and comparisons with the machinery costs on conventional farms will be made.

Finalizing the construction of the baseline analysis will be followed by the calculation

of the effects of the new technologies as suggested in WP1 (Sørensen, 2001). It is, expected that the yield effect and the costs are difficult to estimate as the technologies are not commercial available. Therefore a maximum investment level will also be calculated indicating when investment in a given technology is profitable. It is likely that the largest impact of the new organic technology will be on of arable farming, as conventional farms will also use some of the other technologies adopted. Another possible scenario at the farm level would be increased co-operation between different farm types, the effect of changes in crop prices and the impact of new regulation.

WP3
At the regional level, the needs for data and behavioural parameters have been identified. Data requirements will be fulfilled on the basis of existing farm accounts statistics from FOI, supplemented with data from work package 2. Parameter requirements include parameters for input substitution and agricultural activity composition on organic farms, as well as coefficients for the conversion between conventional and organic farming. As the existing data foundation is too weak for econometric estimation of behavioural parameters for organic farms, such parameters will be provided on the basis of estimated parameters for conventional farms, adjusted to organic agriculture on the basis of findings from the international literature.

WP4
The organic dynamic version of the AAGE model has in its first version been implemented and it is now working in a preliminary version (a less ambitious version, cf. the discussion below). Preliminary data from work package 2 and 3 has been used so far in the development of the model. The model is capable of simulation the development of organic farming in the medium and long run taking into account parts of the dynamic adjustments processes necessary to convert conventional farming into organic farming. The theoretical microeconomic foundation is therefore currently being implemented allowing for short run dynamic behaviour in organic farming. Current results yield credible results but intensive testing and evaluation still need to be undertaken.

The collection of macroeconomic data for capital stocks, investments and rates of return has been carried out as well as the data has been adjusted and implemented in the overall model structure.

The developed theoretical specification of the model describes the short and long run behavior in the agricultural sector with specific features regarding:

- The allocation of land between agricultural sectors (organic and conventional) is determined in the short run by sector specific rate of return to land and the average return to land and by a parameter representing the risk aversion of the farmers. In the long run rate of return to land is equalized across all the land using sectors.
- The model covers land under conversion to organic production on a net-basis, that is only if the total organic land increases will allocation of conventional land to organic production take place, and on the other hand only if total organic land decreases will organic land be allocated for conventional purposes.
- Organic land using sectors produces two commodities, an organic and a conventional product. The mix is determined by the fraction of land being fully organic in the specific sector.

- A novel feature of the model is the possibility of excess production in the organic sectors in the short run and the ability to analyze the contributing factors behind this excess production, e.g. conversion period, organic subsidies and behavior in the processing industries.
- The possibility of large growth rates in the organic industries often more then 100 pct. This requires a new specification of capital with the possibility of capital moving between conventional and organic sectors.

Identification of baseline principles and collection of data is almost finished from WP 5. To take advantages of this, the necessary data for simulating a baseline scenario has been collected facilitating the construction of a baseline that describe the historical period 1995-2001 and the forecast period until 2010/20. The illustrative scenario will be reported as changes to this baseline. Currently under consideration for the illustrative scenario is the determination of the driving forces behinds excess production.

WP5
The identification of the important principles for constructing a baseline using the dynamic AAGE model has been completed and a credible baseline for the standard model (without organic farming) has been constructed for the period 1995 to 2010. Work to extend this baseline to organic farming is also in progress. A FOI research report on the principles for constructing a credible baseline has been published and currently this work is being extended to include organic farming in the baseline. A few illustrative scenarios have also been undertaken with a preliminary version of the model illustrating possible contributions by organic farming to obtaining environmental goals through either market based development of organic farming versus using actively subsidies to organic production or taxing conventional production.

The illustrative scenarios indicate, that a growing organic production reflecting increased demand and prices for organic products (a market based growth) will lead to a growth in the size of the sector as measured by both the volume of production as well as the size of the agricultural area being grown in accordance with the principles of organic production methods. On the other hand, a growth being driven by increased subsidies to organic land will lead to an extensification of the organic production as the size of organic land will increase somewhat while the total production and sales of organic production will only increase marginally compared to a market based growth.

C.2 Fulfilment of deliverables and milestones

WP1: **Labour and machinery systems in organic farming**	Time schedule, according to application	Deviations, if any*
Deliverables		
1: Paper on existing labour and machinery data on organic farming tasks	1.12.2001	
2: Paper on innovative technologies and work methods	1.06.2002	
3: Whole-farm analysis of labour and machinery demand, labour budgets and labour profiles for selected farm types with a specified collection of work operations (DIAS report)	1.06.2003	
Milestones		
1: Existing labour and machinery data related to organic production practices identified	Accomplished	
2: Completion of plan for data acquisition on labour demand and machinery capacities	Accomplished	
3: Selected technologies and work methods	Accomplished	
4: Preliminary completion of collection of data on labour demand and machinery capacities for selected technologies and work methods	In progress	Postponed
5: Selection, design and analysis of model farms with adapted technologies	In progress	Pushed forward

** Deviations are to be further discussed below.*

WP2: **Organic farming at the farm level – A study of the conversion process**	Time schedule according to application	Deviations, if any*
Deliverables		
An FOI report on Ø-plan Dairy	Not in application	1.09.2002
4: An FOI paper on the machinery and labour costs	1.09.2002	1.12.2002
5: An FOI paper as documentation for the new Ø-plan model	1.10.2002	1.02.2003
7: An FOI paper on the data to be used in the sector analysis	1.02.2003	1.04.2003
8: An FOI report on the results from the different farms	1.10.2003	
Milestones		
1: Labour and machinery data from WP1	Accomplished	
2: New crop rotations and farm types are included in Ø-plan	Accomplished	
3: Nutrient surplus are included in Ø-plan	In progress	
4: Machinery and labour for new technologies are included in Ø–plan	In progress	
5: Verification of the whole farm results in relation to study farms	In progress	
6: Analyse the impact of changes in regulation etc.	In progress	
7: Data for sector analysis are prepared	In progress	
8: Report on the effect of different scenarios on model farms		

** Deviations are to be further discussed below*

WP3: **Economic Analysis of organic farming at the regional level**	Time schedule according to application	Deviations, if any*
Deliverables		
9: An FOI-working paper on the development of ESMERALDA to allow for analysis of organic farming	1.02.2003	1.05.2003
10: An FOI-report on baseline results and a selected number of policy scenarios (regional focus)	1.10.2003	
Milestones		
1. Study of the representation of organic farms in the ESMERALDA database	In Progress	
2. Determination of behavioural parameters for organic farms		Postponed
3. Representation of organic farms on a regional basis (aggregation)		Postponed
4. Linking of environmental indicators to organic farms		Postponed
5. Economic potentials for organic farming in different regions of Denmark		
6. Undertaken policy scenarios. Report on results		

** Deviations are to be further discussed below*

WP4: **Development of a dynamic general equilibrium model with organic farming**	Time schedule according to application	Deviations, if any*
Deliverables		
FOI-report on the standard dynamic AAGE model	Not in application	1.01.2002
D11: An FOI-working paper documenting the theoretical structure chosen and the applied economic data and environmental indicators. The working paper will also discuss similarities and differences across organic sectors and across conventional and organic farming sectors.	1.11.2001	1.03.2003
D12: An FOI-report describing the dynamic version of the AAGE model and a few illustrative scenarios focusing specifically upon the new features relative to the static version of the model.	1.06.2002	1.04.2003
Milestones		
1. Identification of the theoretical microeconomic model structure and associated data.	Accomplished	
2. Data collecting of macroeconomic data such as capital stocks, investments and rates of return	Accomplished	
3. Data collecting of environmental indicators and adjusting them to the rest of the database and model.		Postponed
4. Adjustments of farm level data for organic farm types delivered from work package 2.		
5. Adjustments of behavioural parameters in CGE model according to results found in work package 2 and 3.		
6. Programming the dynamic version of the general equilibrium model and 'fitting data to that structure'.	In progress	
7. Testing the implemented dynamic model.	In progress	
8. A fully operational dynamic version of AAGE general equilibrium model documented.	In progress	

** Deviations are to be further discussed below*

WP5: **Economic analysis of organic farming at the sector and macroeconomic level**	Time schedule according to application	Deviations, if any*
Deliverables		
D13: An FOI report analysing a number of different scenarios, including a baseline scenario describing possible future developments of organic farming in Denmark.	1.10.2003	
D15: An FOI report concluding on the overall project with its main focus on the overall results found in the research project – from field level to farm, regional and sector and macroeconomic level.	1.01.2004	
Milestones		
1: Identification of principles for constructing a baseline using the dynamic AAGE model	In progress	
2: Identification of major determinants behind the development of organic farming	In progress	
3: Identification and design of baseline scenario and policy scenarios.	In progress	
4: Undertaking simulations and undertaken sensitivity analysis.		
5: Documenting the work and the results found in research report and in popular and scientific articles		

** Deviations are to be further discussed below*

D. Description of deviations and subsequent adjustments of plans

WP1
The tasks concerning review of existing labour/machinery data and the identification of missing data as well as the identification and evaluation of new/innovative technologies for organic farming system have been accomplished as scheduled.

The tasks of collecting labour/machinery data, analysis of labour demand and machine capability, and preparation of results for economic results, these have been postponed as a result of the conclusions from the preliminary evaluation of the need for labour and machinery data. In order to increase the efficiency and focus of the labour data acquisition it was concluded that the specific selection of case farms be known. Consequently, the designing of case farms representing typical organic farming systems has been pushed forward in time, whereas the tasks of collection data and analysing the case farms have been delayed a few months. The work related to the collection of data on labour demand and machine capabilities, the related analysis of these data and the preparation of data for the economic analysis will be completed within the revised time schedule. The analysis of machinery systems and labour profiles for case farms are well underway and is expected to be finished within the original time schedule.

WP2
The work is generally progressing as planned although the work on Ø-plan has focused somewhat more on the development of Ø-plan for dairy than originally anticipated. It was found necessary and useful to calculate and publish the effects of new prices and 100% organic feed requirement thereby contributing to the debate and concerns on the present challenges meet by organic farming. This work has now been concluded, cf. Tvedegaard, 2002. As mentioned above this FOI report was not originally schedules as part of the overall research package. As a consequence of the increased focus on the dairy component, the work on other parts of Ø-plan (machinery and N+P surplus) is therefore slightly delayed. This work is, nevertheless progressing satisfactorily at the moment. The calculations of the data needed for the sector analysis is therefore also delayed somewhat. The “translation” of farm level results to sector level input will be carried out according to procedures previously used in the Bichel-committee, and the task is expected to be finished at the beginning of 2003.

WP3
The objective of WP 3 is to adjust the sector econometric model ESMERALDA to describe and analyse organic farming at the regional level. It has been decided to concentrate the main part of this work package’s efforts to a shorter time period than originally planned. This is in part motivated by the regard to overall coordination of staff use within FOI, and in part by the dependency on data from other work packages.

Compared to the original time schedule, deliverable 9 is postponed by 3 months whereas the final deadline for deliverable 10 is unchanged. This revision of the work

plan will not lead to any serious disturbances for the remaining part of the research project. Except for the coordination in the construction of scenarios, other work packages do not depend on results from WP3. The project will be completed in due time for this coordination.

WP4

The objective of work package 4 is the development of a Dynamic General Equilibrium Model, which allows for a quantitative assessment of the development of organic farming in Denmark.

During the initial year of the work package a few tasks was delayed whereas others have been undertaken a few months earlier than originally expected. The time schedule of some of the tasks was changed to take advantage of the visit of Dr. P. Adams, Monash University and CoPS, Australia. This means that these tasks have taken place earlier than expected and therefore specific organic features of the model have been programmed and the implemented features undergo currently appropriate testing. Instead the collection of data for environmental indicators has been postponed somewhat. This decision has been taken to free up core researchers time to tackle the technicalities described below. Since this task related to the collection of environmental indicators does not involve any modelling to the core model it has been decided allocate this task to a researcher or student from outside the project staff.

Adjustment of farm level data for organic farm types and behavioural parameters are presently awaiting final deliverances from WP 2 and 3. In its preliminary version of the model provisionally result from WP 2 and 3 is used instead.

During the last year it was in light of the experiences gained during the first 12-16 months of model developments and the changed conditions for the production and demand for organic products in Denmark (i.e. excess supply of organic products, stagnating demand for organic products, falling product prices and only relatively few farmers recently converting into organic farming) concluded to adjust the focus of the project somewhat.

It was therefore decided to expand the representation of organic farming in the dynamic general equilibrium model of the Danish Economy into a full dynamic model specification in which the dynamic process of converting land and capital into organic production is explicitly represented in the model (tracing the movement and use of land and capital in the farming sectors) also focused is the novel ability to simulate excess production as a short term phenomenon.

This allows for not only construction a baseline as a forecast but also to replicate the historical period from 1995 to 2001 in the baseline. The emphasis is to understanding the underlying forces resulting in excess production. That is, what is the role of timing between farmer's decision and actual organic production, what is the role of organic subsidies and price setting by market leaders? Since the historical simulation mimics the actual development in organic land use and production it also allows for alternative scenarios where the relative impact of these different underlying forces are measured.

This has, however, turned out to be somewhat more technically difficult than original expected – also a reflection of the very novel (by all international standards) approach applied. This has unfortunately lead to a significant delay in the development of the dynamic economic model, although it is still expected that the final version of the model will be finished in time to allow most of final year of the project to be devoted to the construction the baseline as well as undertaken the necessary policy relevant scenarios. Additional resources has been devoted to solving these technical problems, including the continued assistance by Philip Adams, Monash University, Australia, still working in cooperation with the FOI-team to solve these problems.

WP5

The objective of work package 5 is to construct a credible baseline scenario and to undertake a number of policy scenarios using the organic dynamic version of the AAGE model.

According to the plan work package 5 was to be initiated in 2002. Parts of the effort have, as described above, already been done, i.e. the identification of principles for constructing a baseline using the dynamic AAGE mode. This work was started somewhat earlier to take advantages of Dr. P. Adams visit at FOI.

E. Project publications and other products

1. Articles in international, scientific journals with review procedures

2. Papers presented at congresses, symposiums, etc.

Andersen, Lill, Lars-Bo Jacobsen and Philip Adams (2002), Structural forecasts for the Danish Economy using the Dynamic-AAGE model, Presentation at the Fifth Annual conference on Global Economic Analysis, Taipei, Taiwan, June 4-7, 2002.

Andersen, Lill, Lars-Bo Jacobsen and Philip Adams (2001), Does timing and announcement matter? Restricting the production of pigs within a dynamic CGE model, Presentation at the Fourth Annual conference on Global Economic Analysis, Purdue University, Indiana, USA, June 27-29, 2001.

Frandsen, S.E. (2002), Development and use of a Dynamic Model of the Danish Economy: A structural forecasts Presentation at the X Congress of the European Association of Agricultural Economists (EAAE), Zaragoza, Spain, August 28-31, 2002

Lars-Bo Jacobsen (2002), Do support payments for organic farming achieve environmental goals efficiently? Paper presented at The OECD Workshop on Organic Agriculture 23-26 September 2002, Washington D.C., United States

Lars-Bo Jacobsen (2002), Is the promotion of organic farming the most cost efficient way of achieving environmental goals? - A Danish Case story. Paper presented at the 14th International Input-Output Techniques Conference 10-15 October 2002, Montreal, Canada.

Kledahl, Poul (2002). Who are the potential organic farmers? Limits to growth in organic farming in Denmark. Paper presented at the 13th International Farm Management Congress, Arnhem, The Netherlands.

3. Reports, articles in agricultural journals, etc.

Adams, Philip (2000): Dynamic AAGE – A Dynamic Applied General Equilibrium Model of the Danish Economy based on the AAGE and MONASH models. Report no. 115, Danish Institute of Agricultural and Fisheries Economics (Report in Co-operation with the FOI-Policy-team)

Adams, Philip, Lill Andersen and Lars-Bo Jacobsen (2001): Structural forecasts for the Danish Economy using the Dynamic-AAGE model, SJFI preliminary draft: 25. September 2001.

Andersen, Lill (2002), Dansk svineproduktion i perspektiv: udviklingsmuligheder og udfordringer (Perspectives for the Production of Danish Pork – Possibilities and challenges), forthcoming report from Danish Institute of Food Economics. **

Baltzer, Kenneth (2002), Efterspørgslen efter fødevarekvalitet og –sikkerhed: Et pilotstudie af danske forbrugers efterspørgsel efter æg (Demand for food quality and safety – The Case of demand for Eggs), FOI Working Paper no. 11/2002. **

Jacobsen, Lars-Bo: Opfølgning på præsentationen af SJFI rapport nr. 121 på mødet i Det Økologiske Fødevareråd den 12. juni 2001

Jacobsen, Lars-Bo, Paul Rye Kledal og Niels Tvedegaard (2001): Produktion og afsætning af økologisk mælk 1995 – 2006. Notat udarbejdet til Departementet for Fødevareerhverv.

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F. Scientific education

Dr. Phillip Adams from CoPS and the IMPACT project at the University of Melbourne Australia has during 2000 and 2001 visited FOI for a longer period. He has in co-operation with the FOI-Policy team contributed to the development of the Dynamic AAGE model with a particular focus on the dynamic specification, structural forecasting and features related to the technical specification of organic farming and its adjustments processes. The co-operation with Philip Adams and several other researchers at the University of Melbourne, Australia, has continued since his return to Australia and it is envisaged that Philip Adams again will visit Denmark and The Danish Research Institute of Food Economics within the two years.

G. National and international cooperation

WP1

WP1 is associated with a number of ongoing research projects within The Danish Institute of Agricultural Sciences (DIAS), covering topics like the fertility of the soil in relation to organic cropping praxis and soil treatment, weed control, and row cropping systems (e.g. *Band heating for intro-row weed control* (BANHEAT)).

WP1 is using information and experiences obtained from international contacts and co-operation (e.g. CIGR-Working Group 17: “Models, Methods and Database for Labour and Machinery in Agriculture” with participants from Germany, The Netherlands, Finland and Denmark).

WP2
A close contact to local organic advisors mainly in the Southern part of Jutland and at the Danish Agricultural Advisory Centre in Århus is undertaken as an integrated part of the research.

There is close contact with the FØJOII project on new production systems in organic pig production (e.g. questionnaire on workload (WP1) and assumptions for the Ø-plan calculations).

WP4 and WP5
The project is co-ordinated with other economic research projects at the FOI, including the SSF financed research project entitled: ”A dynamic General Equilibrium Model of the Danish Economy”, which has made the visit of Dr. Philip Adams possible. In addition synergy is obtained by linking the present research project to a larger research project focusing on the perspectives of the Danish pig production and its economy-wide impacts financed by Norma and Frode Jacobsens Fond as well as a large research project focusing on the food quality and safety issues financed under the so-called “Innovation Law”. The significant costs associated with developing the dynamic model is thereby split between several distinct research projects.

The project is also co-ordinated with the DARCOF II research project headed by AKF (project III.1). That project focuses in particular on the consumption of and willingness to pay for organic products. Results from that research project will be used in the construction of the demand system in the organic version of the dynamic general equilibrium model of the Danish Economy.

H. Critical reflection on the project

The key focus of the present research project is economic modelling of organic farming at the field, farm, sector and macroeconomic level. The objective is in particular to integrate the different approaches to addressing economic challenges facing the organic farming sector in Denmark keeping in mind the overall objectives of DARCOF II. As mentioned above particular efforts are also devoted to co-ordinate this project with project III.1 focusing in particular on the demand for organic products.

The contribution to the overall objectives of the DARCOF II is therefore to add an economic perspective to the overall research package hoping thereby to contribute to the discussion of the future development of the organic farming sector in Denmark. The recent development of demand and supply of organic products in Denmark and in particular the excess supply of organic production, falling prices and the discussion of the future of the Common Agricultural Policy also stresses the importance of developing a "economic tool-box" enabling the analyses of these challenges and possible changes in the economic and policy framework in which the organic sectors will be developing the coming years.

The objective of the research project and the methods applied are clearly unique by international standards. Several of the research activities and the developments of the economic models are new and challenging and in addition relative difficult problems to solve technically. Nevertheless, the issues being addressed are highly relevant to the future development of organic farming. The technical challenges have in part lead to some delays while other tasks as been undertaken somewhat quicker than originally anticipated. The changes and challenges facing organic production during the last 12-15 months has also lead to some adjustments in the research efforts stressing even stronger the need for understanding the dynamic adjustment processes of converting conventional farming into organic practices, cf. the discussion below in each of the work packages.

WP 1.
The standard method used for data acquisition on labour and machinery data and knowledge is the work-study with its precise measurement of all relevant part operations contained within a work process. This method ensures that it is possible to create labour models predicting labour and machinery input under various circumstances. However, the method is resource demanding and this project does not allow for a comprehensive use of the concept for acquiring data on new work methods and technologies used in organic farming. Instead, a compromise has been reached allowing for qualified adapting of existing data and the use of a questionnaire as the way of collecting supplemental empirical data. On this background it is important that special considerations as to the constraints on the use of such acquired data be recognised.

The use of older data for adaptation to new technologies also requires special attention. To some extent it will be possible to extend and adapt the use of available data to new technologies by considering the special new features of the technology. If, however, such new features differ very significantly from the existing technology the invoking of a detailed study would be required. When this is not possible, the constraints on the analysis have to be taken into account.

Detailed labour and technical analysis of horticultural production methods is not carried out due to lack of comprehensive empirical data on this production type. Only newly generated aggregated data based on expert assessments are available (Ørum & Christensen, 2001) and would not be sufficient for the analysis at hand. As this project gives no opportunity for collecting new detailed and comprehensive empirical data such analyses have been discarded. However, in connection with the analysis of the selected case farms the possibility and perspectives of including horticulture production as a supplement or a substitution for parts of traditional plant production will be discussed.

Even as organic pig production only comprises a small segment of the organic sector this production has been included in the case farm analysis. Labour and machinery data and analysis are in demand because there is a need to identify the most feasible production systems in terms of labour and technology input. A number of specific research activities within organic pig production (e.a. the FØJO project: *Resource use, environmental impact and economy in organic pig production systems (PIGSYS*)) are requiring the availability of data on labour and machinery input for evaluating the production economy.

Ørum, J.E.; Christensen, J. (2001). Produktionstekniske analyser af mulighederne for en reduceret pesticidanvendelse I dansk gartneri. Rapport nr. 128, Statens Jordbrugs- og Fiskeriøkonomiske Institut, 2001 (not yet published)

WP2

The perspectives for organic crop production have changed dramatically since the start of the project. It was in year 2000 anticipated that the 100% organic feed requirement on dairy farms in years to come would increase the demand for organic feed well beyond the supply. But since then the 100% feed requirement has been quickly adopted and the area with organic feed increased. As the supply of feed more than equalled the demand, there has been a large decrease in organic grain prices. This illustrates the volatility of a small market where exports are limited. This also shows the need for sensitivity analysis on prices in relation to the conversion, and underlines the risk involved.

The use of the case farm approach limits the possibilities of a cost analysis on a wide range of farm types. It does on the other hand allow for a detailed analysis of the cost and labour use based on the detailed data received from WP1. The case farms could have included full time arable farms with organic vegetables in their crop rotation, but it was chosen to only include the arable side. It is now intended to include some general analysis at the farm level, where the effect of more vegetable in the crop rotation on workload and income. The conclusions will, however, not be incorporated in the sector analysis.

In the data transition process from farm to sector level some details regarding specific production systems at the farm level has to be translated to the sector level being represented as one representative organic farm. This transformation is both difficult and unique, and one important parameter is the change in capital requirement for farms converting from conventional to organic. It is the intension that sector results will be related back to the farm level in order to give the farm level interpretations and implications.

WP3
The methodological basis for WP3 is the farm-based econometric sector model ESMERALDA, which is based on data for Danish conventional farms and econometrically estimated behavioural parameters for these farms. As the data foundation concerning organic farms is much weaker than for conventional farms, it is not possible to provide corresponding econometric estimates of behavioural parameters for organic farms. One specific type of missing behavioural parameters comprises parameters for the conversion between conventional and organic farming. These problems were also anticipated in the initial project proposal, which outlined a range of alternative approaches to obtain such parameters from e.g. international literature, normative simulations and adoption and subsequent modification of parameters related to conventional farms. As such parameters for organic farms will have a relatively weak empirical foundation and thus can be expected to be subject to some uncertainty, sensitivity analysis with respect to parameter values will be conducted. As the regional distribution is expected to be less sensitive to these parameters than the absolute extent of organic farming, this implies that the main contribution from WP3 is the regional distribution of organic farms under different economic conditions.

WP4 and WP5
While the first version of the dynamic model works well in the medium to long run it turned out, that the first version of the model is less accurate in the “years to year” dynamic in the short run. It was furthermore difficult to replicate historical large growth rate in the organic production without running into mathematical problem with the simulation software. The research has identified that these problems relates to:

a) The initial capital specification
b) Calculated land rentals

The capital specification in the initial model was specified in a way that required all capital in a sector to be specifically built for that sector. While this is reasonable approximation for an industry specification producing heterogeneous products it turns out that it limits the growths potential in the short run for the organic agricultural sectors where some capital from the conventional production can be readily used. A new specification of capital formation is therefore designed for the agricultural sectors where existing capital is specified as putty-clay technology.

In the short run, land rental rates fluctuate in a way that in some simulation results in inability to solve the model. The problem is twofold, the first relates to the capital specification mentioned above, inflexible capital adjustment in the short run results in highly/to flexible land rentals in the short run. The other part of the problems relates to having the software solve an equation system with sub-matrixes consisting of relative small number (equations describing organic features) compared with number in the rest of the equation describing the model.

Currently the new capital specification is being implemented into the model while research is still progressing with solving the mathematical problems.

It was furthermore decided to heighten the level of ambition concerning the scenarios that the model will be capable of simulating. This was due to the slow down of the

growth of consumer interest in organic production and entry into the organic sector as well as growing concerns about the excess production in the organic sector it was therefore decided to include the following aspect into the project.

c) Accounting identities tracking land under conversion
d) Explaining excess production
e) Explaining the historic development in the period 1995-2001

Adding these features allows for construction of a baseline that includes actual history with important variables being determined endogenously. The reason for this is to understanding the underlying forces resulting in excess production. That is, what is the role of timing between farmer's decision and actual organic production, what is the role of organic subsidies and price setting by market leaders? Since the historical simulation mimics the actual development in organic land use and production it also allows for alternative scenarios where the relative impact of these different underlying forces are measured.

These features and the fact that the first two tasks in WP 5 are finished before planed allows for letting the construction of the baseline take place in Work Package 4 instead of Work Package 5. This means that the illustrative scenario will be reported as deviation to the baseline.

These changes to the original plan are all implemented or under implementation except c) above where intensive research are currently in progress. Considering the overall time schedule it is still expected that the delays and heighten ambitions will not affect the time schedule of the overall project.

8. Budget

A. Account for any change in budgets

Due to the delay of a few of the tasks it has been decided to postpone 300.000 Danish Kr. from year 2002 to 2003.

B. Budget for the whole project (1.000 DKK)

Total consumption of funds from DARCOF and expected consumption this year and coming years

Year:	Consumption before 2002	Expected consumption 2002	2003	2004	Total
Man-months					
Scientific personnel	30,5	31,5	29,5		91,5
Technical personnel	6,5	9,5	6,0		22,0

Year:	Consumption before 2002	Expected consumption 2002	2003	2004	Total
Salaries					
Scientific personnel	1110	898	1324		3332
Technical personnel	143	209	132		484
Other operational costs	283	338	255		876
Equipment	0	0	0		0
Others (please specify)	0	0	0		0
Direct costs	1536	1445	1711		4692
Indirect costs (20% of direct costs)	307	289	342		938
Total	1843	1734	2053		5630

Comments:

9. Signatures and stamps

Name	Institute	Date	Signature
Head of project Research Director Søren Elkjær Frandsen	Danish Research Institute of Food Economics	1.10.2002	

Appendix I. Detailed budget

A. Budget for each participating institute (1.000 DKr)

Name of Institute:
Danish Research Institute of Food Economics

Year:	Consumption before 2002	Expected consumption 2002	2003	2004	Total
Man-months					
Scientific personnel	25	25	25		75
Technical personnel	3	3	3		9

Year:	Consumption before 2001	Expected consumption 2002	2003	2004	Total
Salaries					
Scientific personnel	910	660	1160		2730
Technical personnel	65	65	65		195
Other operational costs	200	200	200		600
Equipment	0	0	0		0
Others (please specify)	0	0	0		0
Direct costs	1175	925	1425		3525
Indirect costs (20% of direct costs)	235	185	285		705
Total	1410	1110	1710		4230

Comments:

B. Budget for each participating department (1.000 DKK)

Name of Institute and department:
Danish Institute of Agricultural Sciences, Dept. of Agricultural Engineering

Year:	Consumption before 2002	Expected consumption 2002	2003	2004	Total
Man-months					
Scientific personnel	5,5	6.5	4.5		16.5
Technical personnel	3,5	6.5	3.0		13.0

Year:	Consumption before 2000	Expected consumption 2002	2003	2004	Total
Salaries					
Scientific personnel	200	238	164		602
Technical personnel	78	144	67		289
Other operational costs	83	138	55		276
Equipment	0	0	0		0
Others (please specify)	0	0	0		0
Direct costs	361	520	286		1167
Indirect costs (20% of direct costs)	72	104	57		233
Total	433	624	343		1400

Comments:

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