

# Utilisation of alternative scenario approaches in defining the policy agenda for future agriculture in Finland

Doctoral Dissertation

Pasi Rikkonen



Agrifood Research Reports 73  
223 p., 8 appendices

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*Academic Dissertation  
To be presented, with the permission of  
the Council of Teaching and Research of  
the Turku School of Economics and Business Administration,  
for public examination in Auditorium 17, Rehtorinpellonkatu 3, Turku,  
on November 18th 2005, at 12 o'clock.*

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Custos: Prof. Satu Lähteenmäki, Turku School of Economics and Business Administration

ISBN 951-729-974-5 (Printed version)

ISBN 951-729-975-3 (Electronic version)

ISSN 1458-5073 (Printed version)

ISSN 1458-5081 (Electronic version)

[www.mtt.fi/met/pdf/met73.pdf](http://www.mtt.fi/met/pdf/met73.pdf)

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MTT Agrifood Research Finland

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Publisher

MTT Agrifood Research Finland, Economic Research, Luutnantintie 13,  
00410 Helsinki, Finland

[www.mtt.fi/mttl](http://www.mtt.fi/mttl)

Distribution and sale

MTT Agrifood Research Finland, Economic Research, Luutnantintie 13,  
00410 Helsinki, Finland

Phone +358 9 56 080, Fax +358 9 563 1164

e-mail [julkaisut@mtt.fi](mailto:julkaisut@mtt.fi)

Printed in 2005

Printing house

Vammalan Kirjapaino Oy

Photographer

Tapio Tuomela/Copyright: MTT

# Utilisation of alternative scenario approaches in defining the policy agenda for future agriculture in Finland

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## Abstract

In this thesis, future agriculture in Finland was approached with several future-oriented case studies which raised questions about the scenario-based strategic planning of public agricultural policy. The general goals of the thesis were therefore: (1) to present alternative agricultural scenarios and key strategic challenges in the operational environment of agriculture up to the year 2025, (2) to present scenario narratives and alternative future paths of Finnish agriculture according to an expert-based Delphi and a model-based study, and (3) to raise discussion of the desirability, probability and feasibility of the alternative future development overall in agricultural sector. The main emphasis was on scenario development and its techniques in constructing alternative future outcomes for policy planning and preparation. The contribution of this thesis lies in (1) an evaluation framework for the interpretation of strategic challenges, (2) the development of the utilisation of Delphi techniques in scenario planning and, concretely, in construction of scenarios, (3) the sustainability evaluation of the chosen policy scenarios according to an indicator set-up, (4) a comparative approach to evaluate the differences within the interest and stakeholder groups' future views in the agricultural policy agenda and, lastly, (5) a general review to the discussions of the linkages between the use of expert information, scenario planning and strategic planning processes.

As a result based on the expert panel data, it was argued that the most important strategic challenges in the future of Finnish agriculture will be: (1) structural changes and especially depopulation in rural areas, (2) the profitability of agricultural production, (3) the demand for home-grown agricultural products, as well as (4) the European Union's (EU) political control on agriculture. Furthermore, (5) the future agricultural support system will, naturally, set boundaries for agricultural production in Finland as the enlargement process of the EU continues. Overall, the Delphi results indicate that the regional concentration of agricultural production continues. In southern and western parts of Finland, there is just a slight decrease in total cultivated area; in eastern and northern parts, the change is more dramatic. Even the median alternative indicates that the cultivated area can drop to half in these areas. The total amount of agricultural production (arable crops and livestock production) seems to decrease, but only fractionally so. Also, fewer farms will exist as the panel expects the number of farms will halve by 2016. It seems rather certain that genetically modified (GMO) varieties

will enter commercial farming in Finland from 2010 up to 2012 at the latest. In general, the expert panel had a strong faith in technological development and in technological innovation.

When comparing the farmer and agri-food expert panels, it is seen that they share a resilient faith in technological development and see that increasing the efficiency of both production and environmental protection as being necessary and compatible. Both of the groups also see the role of agriculture in keeping rural areas alive and inhabited as a crucial future policy question. The differences in the farmers' and experts' future images are most apparent when concerning the future of farm structures. There is no agreement as to what farm structure will look like in the future. It is also obvious that farming identity and the concept of the family farm will become a more complicated issue. There is tension between the polarisation of farms in size, geographical location, production line, and income sources. This will apparently have direct effects on the sustainability of agricultural production both in terms of ecological, economic and social impacts.

The evaluation framework of strategic challenges has been able to reveal strategic topics in several dimensions. It has addressed the areas of consensus and areas of disagreement and uncertainty. Based on these results, three scenarios and two mini-scenarios were developed. The chosen tripartite design of constructing scenarios through the Delphi technique bring into the discussion a more comprehensive way of foreseeing the future. First and foremost, it introduces a wide range of sustainable agricultural variables as future images. Furthermore in this study also, the relative importance of the changes, variables and trends was rated by the panel. This importance analysis gave an opportunity to point out first those topics which can be considered as basic premises and also those topics representing key uncertainties according to the views of the expert panel. Subsequently, as a third step towards the construction of scenario narratives together with the first round feedback questionnaire, a more detailed section was constructed for the second round to make the scenarios more profound. This was done through the occurrence points in time and the future path analysis.

It is possible to utilise Delphi panel results in the formation of visions and policy programmes in alternative ways. The depth of the expertise and the broadness of the participating interest groups and stakeholders is the key question to be determined. The scenarios that are constructed with these alternative ways can be used in testing different strategic options. This kind of testing process helps stakeholders to improve the quality of public sector strategies. At the very least, expert based scenarios increase the consciousness of differing views and their arguments on future among the participative interest groups.

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*Index words: Agricultural policy planning, Delphi method, expert information, futures studies, scenario planning, strategic planning, sustainable agriculture*

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# Vaihtoehtoisten skenaariolähestymistapojen hyödyntäminen määriteltäessä tulevaisuuden maatalouden politiikka-agendaa

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## Tiivistelmä

Suomen maatalouteen vaikuttavat lähitulevaisuudessa mm. ruokamarkkinoiden samanaikainen globalisoituminen ja lokalisoituminen, Euroopan unionin laajeneminen, maataloustuotteiden maailmankaupan vapauttaminen, maatalouspolitiikan kuluttaja-, ympäristö- ja maaseutulähtöisyyden vahvistuminen sekä bio- ja informaatioteknologian kasvava rooli tuotannossa ja markkinoinnissa. Tulevaisuuden maatalouspolitiikalla on erilaisia vaihtoehtoja valittavanaan. Poliittikkavaihtoehtojen ja niiden vaikutusten ymmärtäminen on olennaista, erityisesti kun tarkastellaan tulevaa kansallista maatalouspolitiikkaa sekä Euroopan Unionin yhteisen maatalouspolitiikan (YMP) uudistuksia. YMP:n tavoitteena on tukea kestäväää maataloutta, mutta kestävyuden eri ulottuvuudet - taloudellinen, ekologinen ja sosiaalinen - voivat olla keskenään ristiriidassa ja johtaa erilaisiin tulkintoihin paikallisella, alueellisella, kansallisella tai maailmanlaajuisella tasolla.

Tässä tutkimuksessa tarkasteltiin Suomen maatalouden tulevaisuuden vaihtoehtoja erilaisilla skenaariolähestymistavoilla. Tutkimuksessa esitetään vaihtoehtoisia skenaarioita Suomen maatalouden tulevaisuudesta maatalous- ja muun yhteiskuntapolitiittisen päätöksenteon tueksi. Maatalouden toimintaympäristön muutoksia ja niiden vaikutuksia tunnistettiin ja koostettiin tulevaisuudentutkimuksessa paljon käytetyllä Delfoi-menetelmällä. Tutkimuksessa on sovellettu kaksikierröksistä Delfoita. Ensimmäisellä kierroksella tuotettiin asiantuntijoiden tulevaisuudenkuvia perusteluineen Suomen maataloudesta. Toisella kierroksella tarkennettiin ensimmäisen kierroksen vastauksia ja kysyttiin asiantuntijoilta tarkentavia tapahtuma-aika-arvioita sekä muutoksen suuntia skenaarioiden rakentamista varten. Tämän työn kontribuutio on (1) strategisten haasteiden tulkintakehikon kehittämisessä, (2) Delfoi-perustaisen skenaariomallinnuksen kehittämisessä, (3) politiikkaskenaarioiden ja valikoitujen indikaattorien perusteella tehdyssä kestävyystarkastelussa, (4) sidos- ja intressiryhmien tulevaisuudenkuvien eroavaisuuksien vertailevassa tutkimuksessa ja (5) asiantuntijaperustaisen (delfoi) tiedon, skenaariosuunnittelun ja strategisen suunnittelun yhteyksien yleisessä teoreettisessa tarkastelussa.

Tulosten mukaan Suomen maatalouden tärkeimmät strategiset haasteet ovat (1) maatalouden rakennemuutos ja erityisesti maaseudun autioituminen, (2) maataloustuotannon kannattavuus, (3) kotimaisten elintarvikkeiden kysyntä, (4) EU:n poliittinen ohjaus maatalouden ja maaseudun kehityskysymyksissä

ja (5) tulevaisuuden maataloustukijärjestelmän muotoutuminen. Delfoi-tutkimuksen tulokset osittavat, että maataloustuotannon alueellinen keskittyminen jatkuu. Etelä- ja Länsi-Suomessa viljelty peltopinta-ala alenee vain hieman. Itä- ja Pohjois-Suomessa muutos on rajumpi; mediaaninäkemyskin ennakoii, että peltopinta-ala voi vähentyä puoleen vuoden 2001 tasosta. Maatalouden kokonaistuotannon ennakoidaan sen sijaan vähenevän vain hieman. Tilalukumäärä vähenee ja paneeli ennakoii lukumäärän puolittuvan vuoteen 2016 mennessä vuoden 2000 tasosta. Muuntogeenisten kasvilajikkeiden tulo näyttää todennäköiseltä vuoteen 2010-2012 mennessä. Paneeli korosti teknologista kehitystä ja innovaatioita maatalouden kehittäjänä. Delfoi-prosessin tuloksena esitettiin vaihtoehtoisia skenaarioita. Skenaariot olivat ”Mahdollisuuksien maatalous”, ”Teollistuva maatalous” ja ”Maatalous tuuliajolla”. Lisäksi esitettiin kaksi mini-skenaariota, joissa tuotiin esille potentiaalisten yllätysten mahdollisuus muokata maataloutta radikaalistikin. Miniskenaariot perustuvat epäjatkuvuustapahtumaan ja analogiatapahtumaan. Epäjatkuvuutena esitetään ”Odottamaton ilmasto” -miniskenaario, jossa äkillinen ilmastomuutos vaikuttaa dramaattisesti maatalouteen. Analogiatapahtumana esitetään ”Hullun lehmän paluu”, jossa kotieläimiin ja ihmisiin helpommin tarttuva eläintauti vaikuttaa radikaalisti kotieläin- ja maatalouteen.

Kaiken kaikkiaan tutkimus tarjosi kattavan kuvan siitä, minkälaisina elintarvikeketjun piirissä työskentelevät asiantuntijat kokevat maatalouden muutos-paineet ja niiden mahdolliset vaikutukset noin 20 vuoden aikaperspektiivillä. Tutkimuksen ensimmäisessä vaiheessa annetut tulevaisuudenkuvat kertoivat laajan asiantuntijapaneelin mediaaninäkemysten maatalouden tulevaisuudesta. Toisessa vaiheessa tarkennetut kysymykset antoivat yksityiskohtaisempaa tietoa valikoiduista muutoksista vaihtoehtoisten skenaariopolkujen muodossa. Lisäksi tutkimuksessa tuotettiin elintarvikeketjusta koostuvan paneelin näkemys siitä, mitkä ovat maatalouspolitiikan harjoittamisen kannalta tulevaisuuden keskeiset strategiset painopisteet tärkeysjärjestyksineen.

Tämän ennakointitutkimuksen tarkoituksena oli tehdä tulevaisuuden suunnat ja vaihtoehdot konkreettiseksi tämän päivän tietoon perustuen. Ennakointitutkimuksen tärkeys strategisessa suunnittelussa perustuu siihen, miten tuotettua tulevaisuustietoa hyödynnetään strategiavalintojen perustana. Siten tulevaisuustiedon tulee olla uskottavaa, loogisesti etenevää, sisäisesti johdonmukaista ja ajankohtaista suunnittelun tarpeisiin nähden. Yleensä tulevaisuustieto tuotetaan skenaariomuodossa. Skenaariot eivät kuitenkaan ole ennusteita vaan vaihtoehtoisia tulevaisuuspolkua mahdollisista kehityssuunnista. Näiden vaihtoehtoisten tulevaisuuspolkujen pohjalta voidaan tulevaisuuteen varautua paremmin huomioiden mahdollisimman laajasti relevantit toteutumismahdollisuudet.

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*Asiasanat: Delfoi-menetelmä, kestävä maatalous, maatalouspolitiikan suunnittelu, strateginen suunnittelu, skenaariomallinnus, tulevaisuudentutkimus*

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## Acknowledgements

I take this opportunity to thank all who have supported and helped me with this study. First and foremost, I would like to thank my supervisors Dr. Jyrki Aakkula, Dr. Jari Kaivo-oja, Prof. Satu Lähteenmäki and Prof. Paavo Okko. Furthermore, I would like to thank the SUSAGFU research group, Jyrki Aakkula (MTT), Heikki Lehtonen (MTT), Jari Kaivo-oja, (Finland Futures Research Centre, FFRC), Mikael Hildén (Finnish Environment Institute, SYKE), Minna Kaljonen (SYKE), Ilona Bärlund (SYKE) and Sirkka Tattari (SYKE). The research Articles were done during the SUSAGFU project and I am very grateful to the team members for their support, invaluable comments and guidance during the actual work. My sincerest gratitude goes to Dr. Jyrki Aakkula who first offered me a chance to start this process and kept supporting me all along the way.

Special thanks are offered to Prof. Paavo Okko (Department of Economics, Economics) and Prof. Satu Lähteenmäki (Department of Management, Management and Organization) for giving me the support to carry out the post graduate studies in the Turku School of Economics and Business Administration. A special word of thanks must go to Prof. Satu Lähteenmäki for appreciated guidance and support during the postgraduate studies. Also thanks for the Finland Futures Academy (FFA) and especially for Dr. Docent Matti Kamppinen, Dr. Docent Osmo Kuusi and Dr. Docent Anita Rubin for their introduction and guidance in futures studies. I am also grateful to my pre-examiners, Prof. Jukka Kola and Dr. Docent Osmo Kuusi, for their valuable comments made on the manuscript.

I am grateful to the MTT Economic Research, especially to Director, Prof. Kyösti Pietola and Prof. Anni Huhtala for providing excellent research facilities and a stable foundation for this research. The SUNARE research programme financed by the Academic of Finland (co-financed by the Ministry of Agriculture and Forestry) has provided me with economic support between the years 2001 and 2004. This support is gratefully acknowledged.

Many thanks for all the co-workers at Economic Research. Besides research, I have enjoyed the richness of after-work activities. A special mention of thanks goes to Salla Punkari at Economic Research for the technical editing of the manuscript.

I would like to reserve my warmest thanks for my parents, Armi, and my late father, Aapo, for their encouragement and support for this process. Very special thanks to family members, relatives and friends for being part of my life.

And finally, my dearest thanks to my own family, to my wife Marika and to my daughter Milja, for giving me their love and care.

21st September 2005

Pasi Rikkonen



## List of original Articles

This thesis is a summary and discussion of the following Articles, which are referred to by their Roman numerals:

- I: Rikkonen, P., Aakkula, J. and Kaivo-oja, J. 2006. How can future changes in Finnish agriculture and agricultural policy be faced: Defining strategic agenda on the basis of a Delphi study. Forthcoming in *European Planning Studies* in the first quarter 2006. (© Copyright of Taylor & Francis Group)
- II: Rikkonen, P. 2005. Scenarios for future agriculture in Finland - A Delphi study among the agri-food sector stakeholders. Forthcoming in *Agricultural and Food Science, AFS* Vol. 14, No. 3 (© Copyright of Agricultural and Food Science)
- III: Lehtonen, H., Aakkula, J. and Rikkonen, P. 2005. Alternative agricultural policy scenarios, sector modelling and indicators: A sustainability assessment. *Journal of Sustainable Agriculture* Vol. 26, Issue 4, pp. 63-93. (© Copyright of Haworth Press)
- IV: Kaljonen, M. and Rikkonen, P. 2004. Divergent images of multifunctional agriculture - A comparative study of the future images between farmers and agri-food experts in Finland. *International Journal of Agricultural Sustainability* Vol. 2, No.3, pp. 190-204. (© Copyright of Multilingual Matters/Channel View Publications)
- V: Rikkonen, P., Kaivo-oja, J. and Aakkula, J. 2006. Delphi expert panels in the scenario based public strategic planning of agriculture. Forthcoming in *Foresight - the journal of future studies, strategic thinking and policy* Vol. 8, No.1 (© Copyright of Emerald)

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The author was responsible for the planning of the studies, for carrying out the data editing and analyses and was the corresponding author in Articles I, II, V and the main contact author in Article IV. In Article III, the author was responsible for the planning of the indicator set-up and wrote the introduction and discussion Chapters together with H. Lehtonen and J. Aakkula. In Article IV, the author was responsible for the expert panel data analyses and results and wrote the introduction and discussion together with M. Kaljonen.

# Contents

1 Introduction.....	10
1.1 The background of future oriented agricultural policy planning...	14
1.2 The research objectives.....	17
1.3 The main concepts in the thesis .....	19
1.4 Outline of the thesis .....	21
2 Review of material and methods used .....	21
2.1 The methodological base of the Articles.....	21
2.2 The principles in selecting Delphi expert panel.....	26
2.3 The design of the applied Delphi and the scenario building .....	29
3 Results.....	33
3.1 The future oriented perspective for constructing an agricultural policy agenda .....	33
3.2 The main strategic challenges of future agriculture.....	34
3.3 The expert-based scenarios for future agriculture .....	35
3.4 The model-based agricultural policy scenarios .....	36
3.5 The divergent future images between farmers and agri-food experts .....	37
3.6 Linkages between the use of expert information, the scenario planning and the strategic planning.....	38
3.7 A critical evaluation of the used Delphi method.....	39
4 Conclusions.....	42
Future research.....	46
Summary .....	48
References.....	50
Appendices	

# 1 Introduction

In this thesis, future agriculture in Finland is approached with several future oriented case studies which raise questions about the scenario-based strategic planning of public agricultural policy. The purpose of this thesis is to give insights and an interpretation of the agricultural policy agenda through alternative scenario planning, the interpretation of strategic challenges and alternative future images. Furthermore, the thesis outlines different depths and broadness in utilising expert based methods in the strategic planning process in order to generate expert judgements for future development. The general goals of the thesis are therefore: (1) to present alternative agricultural scenarios and key strategic challenges in the operational environment of agriculture up to the year 2025, (2) to present scenario narratives and alternative future paths of Finnish agriculture according to a expert-based Delphi and a model-based study, and (3) to raise discussion of the desirability, probability and feasibility of the alternative future development overall in agricultural sector.

This thesis bases itself on futures studies methodologies. The overall purpose of future studies is to examine, evaluate and propose possible, probable and desirable futures (see e.g. Bell 1997a, 1997b, Kuusi 1999, Kamppinen et al. 2002, Malaska 2003). Future oriented research tries to make the possibilities of future development as concrete as possible according to the information and knowledge of today and of the past. The future contains always an element of uncertainty. Nonetheless, attempts are made to prepare for the future and to deal with its uncertainties. One also tries to control the future, not only to prepare for it by adapting to what is believed to be coming, but to make things happen that are seen as important to have happen. In these sentences, there are two key issues involved, first, the ambition of controlling future development and second, that of managing the future with the information and knowledge that we possess today (Bell 1997a).

The importance of futures studies is based on the level of how future oriented information and knowledge are used in strategic planning and decision making. For example, the scenario building and the utilisation of scenarios is one way of adopting a future oriented way to carry out strategic planning. To get to the level when a decision of utilising a future oriented approach is made depends on the quality of scenarios. They must fulfil certain criteria. They must be plausible, logical, internally logical, and consistent, and moreover, they must be relevant for planning purposes (Van der Heijden et al. 2002). It has to be noted that scenarios are not forecasts but alternative futures which may emerge. The use of scenarios benefits in such a way that the alternative future paths can be considered broadly and therefore one can adapt more efficiently to future challenges by understanding the limits of their development.

Over recent years, agricultural policy planning and formation process has included features that are opening the planning processes closer to futures studies methodology, e.g. consensus conferences (see MAF 2001a, Puolanne and Wilenius 2002). Through these novel planning practices which also welcome stakeholders from wider fields of society, the depth of strategic discussions increases and the outcomes afford more alternatives and arguments for the bases of decision making. In this thesis, one of the main goals is to present alternative scenario approaches as tools for strategic planning. These kinds of approaches for Finnish agriculture have seldom been studied. For example, on Finnish future oriented studies on agricultural development see e.g. Kola 1998, Kola and Nokkala 1999, Kröger 2001, Aakkula et al. 2002, Puolanne and Wilenius 2002. There are also many ways of using the Delphi method and scenario analysis to foresee changes in the agricultural sector (see examples of applications in the agricultural sector, Lafourcade et al. 2000, Zanoli et al. 2000, Angus et al. 2003).

Finnish agriculture has faced an exceptionally dramatic structural transition in the past few decades. These most extensive changes include showing that the number of farms and agricultural labour force have decreased, the efficiency of production has increased mainly because of technological change, agricultural production has been concentrated regionally and specialisation of production has taken place (Kola 1998, Niemi et al. 2005). The most severe and concrete change took place in 1995 when Finland joined the EU. This changed the operational environment of Finnish agriculture and food economy radically. The commitment to Common Agricultural Policy (CAP) meant that Finland was not able to regulate agricultural product prices through national measures alone. For example, the producer price level in Finland lowered by 40-50% right at the beginning of 1995. Taking into account the status of less favoured areas (recognised by the EU, see Niemi 2003), there are also limitations in improving the competitiveness of the agricultural sector. Also, the main challenges of the agri-environmental policy have remained the same for the past ten years. The main concerns have been water protection (phosphorus and nitrogen loading of waters), ammonia, rural landscape, use of pesticides and food quality. In addition, climate change and coexistence of conventional, organic and GMO production have been emphasised.

Agricultural policy field is multi-dimensional in many ways. This is because the principles and practical application of the CAP in the EU emphasise agriculture's different roles and functions in the society. The EU has been forced to re-evaluate its agricultural policy as a response to the external pressures arising from the international agricultural and food trade negotiations with the World Trade Organisation (WTO) as well as the internal pressures arising e.g. from the enlargement of the EU and its budgetary crisis. Also, the CAP has to respond to the growing interest of consumers as to food safety, the quality of food, the production principles and to the challenge of ensuring the welfare of

animals. The challenge facing the EU has been to engage in wider processes of agricultural trade liberalisation while, at the same time, developing agricultural and rural policies which ensure the continuity of agricultural production and which recognise agriculture's cultural embeddings and importance for the rural livelihood (Council 2003).

The CAP is one of the most important drivers of farm intensification and specialisation in the EU. Market pressures and technological development have also contributed to these trends. The recent reforms of the CAP, namely the Agenda 2000 and its Mid-Term Review, have tried to find ways in which to confront these challenges (EC 2003). Perhaps the most relevant directions, from the Finnish perspective, include a single farm payment independent from the production (i.e. de-coupling), the strengthening of the environmental and rural policies, and price-cuts in some agricultural products. There are also other significant driving forces such as the rise of modern biotechnology (breeding, genomics and genetic engineering (GMO)) which have also an important impact on the Finnish agricultural sector. Also, the longer range environmental changes such as greenhouse gas emissions and their impact on climate have to be included in the discussion of future strategic focuses in public sector strategic planning (Bruinsma 2003).

The sustainability of agriculture is a stated target of agricultural policy in international, EU and national arenas. The problem is that sustainable agriculture is hard to define and especially so as to make it operational in the form of practical policy measures. One reason for this is that sustainable agriculture is simultaneously a philosophy and a system of farming (MacRae 1990). In most definitions, sustainable agriculture is considered to have at least three key dimensions, namely ecological, economic and social. These dimensions reflect the development of sustainable agriculture, which has occurred from three major perspectives: as a concept of taking care of the environment and natural resources (sustainability as stewardship), as a system of production to achieve food self-reliance (sustainability as food sufficiency) and as a vehicle for sustaining rural areas and activities (sustainability as community) (Douglass 1984).

Ecological sustainability deals with nature and its ability to cope with the human pressure. The main concerns have been the depletion of natural resources, the deterioration of the environment and the loss of biodiversity. Within the border conditions of ecological sustainability, there is still a range of possibilities to provide society with food and other rural products. This so-called multifunctionality of agriculture encourages farming to play several roles in society and contribute to the wellbeing of rural areas by managing the countryside and the environment. Agriculture is multifunctional by its nature: it is a multi-output activity providing not only commodities, but also non-commodity outputs, such as environmental benefits, landscape amenities as well as cultural heritage (OECD

2001, see also Yrjölä & Kola 2001). Economics contribute to the discussion a perspective of efficiency and the profitability (providing optimal welfare effects). Although the core definition for sustainable development is socio-cultural and strongly related to the human well-being, so far, surprisingly little attention has been paid to these aspects. A possible explanation is that the topics of human welfare are rather broad and vaguely defined (Yli-Viikari et al. 2002, see also Yli-Viikari 1999).

Taking into account changes in the agricultural policy field, there are alternative options and decisions to be made for future development. What then can the role of scenario planning be in this? Future oriented planning can be of great help in shaping alternatives what the desirable and probable future is and what is feasible to achieve in a longer term. Understanding the interrelations and importance of the different topics in the policy agenda is crucial when the CAP and national policy are facing re-framing and re-defining. For example, the CAP is strongly supporting the idea of sustainable agriculture, but the dimensions of sustainability – ecological, economical and socio-cultural – can be contradictory and lead to different understanding and interpretations at local, regional, national and global level.

Future oriented scrutiny suits agricultural policy planning well because of the continuous changes in the sector and policy agenda. Agricultural activities are continuous interaction between ecological, economical, social and technological dimensions (Bruinsma 2003). Thus, we can argue that agricultural practices fulfil the idea of complex decision-making conditions as a multi-problem, multi-dimensional and multi-scale target (Van-Asselt 2000). This is a result of a turbulent and continuously changing operational environment which is also strongly related to agricultural policy. Furthermore, where Finland is concerned, the role of its less-favoured-area status from an agricultural production point of view in a Nordic dimension is notable. European agriculture is extremely diverse, ranging from large, highly intensive and specialised commercial holdings to subsistence farming using mainly traditional practises. Therefore, when national or EU-level agricultural policies are redesigned, less favoured areas will face the greatest challenges in maintaining agricultural production because of their adverse production conditions. The isolated and poorer areas are also most vulnerable to agricultural abandonment and rural depopulation (MacDonald et al. 2000).

In the planning of agricultural sector activities, the management of uncertainty is one of the key challenges. It has to be kept in mind that the future can never be accurately or completely known because of the multiplicity of evolutionary driving forces which shape the future, their interactions and complexity. Consequently, most planners and decision-makers today reject the idea that planning should be conducted against a single most likely image of the future (see e.g. Sotarauta 1996). All in all, European agriculture reflects a complex field of

policy in which complicated interdependencies emerge in a sustainable agriculture point of view. To examine and manage this complex field of policy, futures studies methodologies can benefit.

## **1.1 The background of future oriented agricultural policy planning**

The theoretical framework of this thesis is founded on scenario-based futures studies and on scenario-based strategic planning. Three important aspects of any kind of future planning have first and foremost to be familiar with historical development, i.e. hindsight. Secondly as we study the future and try to prepare for it, we need an information and knowledge base that is founded on today's circumstances and experiences, i.e. insight. Then thirdly, as we refine today's information and knowledge into scenarios or future images, for example, we are foreseeing alternatives of desirable, probable or feasible future development and that is when we are extending our perspective on foresight.

When comparing futures studies approaches to strategic management, we see similarities in the way that they are related with and define the future. More closely, if we look into the concept of strategic planning, Minzberg (1998), for example, defines it as (1) future-oriented planning where the aim is managing the future, (2) controlling future development, (3) today's decision-making where the iterative circle of goals, measures and revaluation takes place, (4) managing the process which leads to particular decisions and (5) the formation of a planning method and technique in order to establish 'our ways of action' (a formal planning process). Futures perspective in organisations can be passive, reactive, proactive or pre-active. Godet (2001, p. 66) has outlined that usually passive attitude towards the future implies that organisation goes with the flow in its strategy process. Reactive attitude implies that organisation is having an adaptive strategy. Pre-active attitude implies that organisation is having preventive strategy. Proactive attitude implies that organisation is able to develop innovative strategic plans.

Scenario analysis has evolved within a variety of disciplines such as management, economics, environmental science, and policy science (an application in management studies see Malaska, 1985). Usually, a scenario typology can be approached, for example, through a specific project goal, process design or scenario content according to Van Notten et al. (2003). There is also a distinction between descriptive scenarios that explore possible futures, and normative scenarios that describe probable and desirable futures (Godet 2000). Despite of the variety in scenario methodology, the utilisation of scenario planning can be based on the strategy context that an organisation has. The advantage to include scenario perspective to strategic planning processes is that it widens both the

time-perspective that an organisation sets focuses and particular strategic goals and also the depth of strategic conversations as it includes several potential future paths for an organisation. It is up to the real decision-makers and visionaries to conclude how extensive the impact of the scenario work on actual decision-making of today is.

Basic start-up information of a scenario analysis can come from different stated strategies where an organisation or a public sector has prepared the key strategic focuses and general guidelines for the future. In the Finnish agricultural sector, this refers to official national strategies concerning the agricultural sector and its future guidelines (see e.g. MAF 1999, 2001a, 2002a, 2002c). These strategies reflect common visions and general goals of both local and national level of the future agriculture in Finland. From these documents, the most significant driving forces, variables and trends can then be refined as a starting point for a Delphi study to get the directions of ongoing changes and the argumentation for them. In Figure 1, a general approach to scenario typology is presented. Graf's (2002) general approach describes also dimensions that were important in the Delphi process of this thesis. The starting point was the official policy goals which have been prepared nationally. Therefore, the study started up from short-term and normative bases and continued from there to a long-term and explorative scrutiny with a Delphi process.

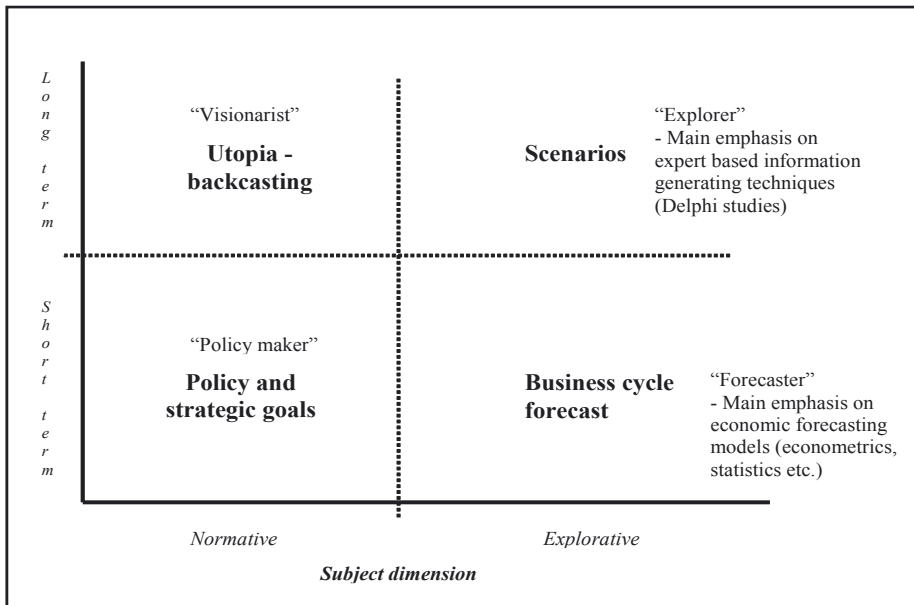


Figure 1. Types of scenarios.



An important part of the utilisation of expert information and scenario planning is its connections to actual strategy processes. The scenario approach is usually connected to the evaluation of possibilities of the operational environment where an organisation operates. Alternative scenarios can input information in influencing the choices of strategies, in the establishment of strategic objectives and action plans, and in the evaluation of the long-term budgets and investments (Seppälä et al. 2003). Scenario thinking can be used within the process of strategic planning to enrich and broaden planning perspectives.

Also, if strategic analysis and scenario development are linked, there is often a learning experience which will influence the destiny of involved activities, persons and organisations. Scenarios can contribute directly to the thinking and action that proceeds from the classic stages in strategic decision making, which are understanding the strategy context, identifying alternatives, developing alternatives, choosing among alternatives, and executing the chosen strategy (Fahey & Randall 1998).

But first, before the scenarios can be elaborated, we need some kind of understanding of the issues that are relevant in the policy agenda. This can be examined, for example, through mapping the strategic importance of the policy agenda issues. It has to be kept in mind that in the agricultural sector, strategy making can be categorised as a political process where the interest groups involved (for instance, ministries and labour unions of agricultural producers nationally, the European Union, etc.) are bargaining and making compromises among conflicting issues in the policy agenda. Usually, there are tensions in visions between the interest groups and stakeholders. One way to analyse these tensions is to categorise the topics in the policy agenda according to their strategic challenge (see, for example, Article I). In this scrutiny, the strategic challenge is interpreted under three dimensions. Firstly, by looking the stakeholders' rated importance individually topic by topic. Secondly, by looking at the differences between the stakeholders' desirable and probable future images as they reveal conflicting issues. Thirdly, by looking at the stakeholders' rated certainty about the realisation of the probable future image. This separates the issues which have either a high or low certainty of the realisation. Basically, this kind of scrutiny allows the stakeholders to discuss the strategic importance of the analysed issues.

The way how stakeholders can evaluate the risk horizon has an impact on the role as to how scenarios are actually interpreted in decision making. For example, a risk lover evaluates scenarios in a different way to a risk averter or risk neutral decision maker (Arrow 1965). When scenario analysis is linked to strategy process, decision-makers could address the following questions according to Fahey and Randall (1998): (1) What strategy alternatives does each scenario suggest? (2) How are these alternatives different from each other? and (3) How different are these alternatives to those currently being considered by the organi-

sation? Before alternatives can be assessed and chosen, they must be developed and detailed so that decision makers can fully understand what the alternative entails. There should be many distinct alternatives, because if there are just one or few alternatives this implies that only one future is presumed.

Stakeholders do not need to develop and detail all the alternatives identified but only those which suggest significant opportunities or those which ward off serious threats. Scenarios can assist in determining which alternatives should be examined in detail. Fahey and Randall (1998) address the following questions for aid in this task: (1) Which alternatives suggest the greatest opportunity for an organisation? (2) Which alternatives most strongly challenge the assumptions underlying current strategy? (3) Which alternatives might be logical extensions of the current strategy? and (4) Which alternatives seem to be suggested by a majority or all the scenarios? Decision makers must continually assess whether, and to what extent, they need to alter strategy which they are executing. If another scenario what is expected to happen seems to be more plausible, a re-evaluation of strategies is needed.

## **1.2 The research objectives**

The research target of this thesis is the public strategic planning of future agriculture. The main emphasis is on scenario development and its techniques in constructing alternative future outcomes for the policy planning process. Also, future images and the interpretation of a strategic challenge of agricultural changes are emphasised. These techniques include mainly expert based and partly (Article IV) quantitative scenario planning. The contribution of this thesis is assumed to give insights of the future possibilities and risks represented as alternative scenarios to the conversation of the planning of agricultural policy in Finland. The key research and also methodological questions are the following.

### **Research questions:**

- What kind of future images and future paths do the experts of agricultural sector foresee?
- What are the key focuses in the agricultural policy agenda according to the experts?
- What kind of trade-offs can there be between different choices when the sustainability of agriculture is evaluated?
- How can these strategic focuses, future images and future paths contribute to the strategic planning and decision-making of future agriculture?

### **The methodological questions:**

- How can the Delphi technique be utilised in generating scenarios?
- How can a quantitative, ‘what if’ policy model be utilised in the generation of policy relevant scenarios?
- How can these alternative scenario approaches and their outcomes be utilised in the strategic planning of sustainable agriculture?
- What is the added value of scenarios in these processes?
- How can a single strategic challenge be interpreted on the grounds of expert information?
- What kind of levels in depth of expertise and in broadness of the participative interest groups and stakeholders can be defined in order to generate relevant expert information for the bases of strategic decisions?

The starting points of this study were the official national strategies concerning the agricultural sector and the use of natural resources. This official agricultural strategy approach has been chosen as a starting point because these strategies reflect the common vision and general goals of both local and national levels of Finland’s agricultural future. Subsequently, the most significant of driving forces, variables and trends have been determined by the careful scrutiny of these strategies and refined as a Delphi process in order to ascertain the direction, importance and certainty of the on-going changes.

The timeframe of the study was determined to be 2020-2025 thus covering approximately three Agenda periods in Common Agricultural Policy framework. Agenda 2000 was made for 2000-2006 and the following one refers to 2007-2013. The chosen timeframe was found suitable for examining both alternative scenarios and strategic challenges which agriculture is facing. A strong argument favouring this timeframe definition is that agricultural investment is usually done on a 20 or 25 years timescale. Thus, agricultural production structure in farming is defined by investment decisions or the lack of investment. In general, a 20 year period can describe representatively the economic, technological, ecological, and institutional change in the agricultural sector.

## 1.3 The main concepts in the thesis

The main concepts used in this study are presented and defined as follows. The more in-depth definitions can be found in the research Articles.

### **Delphi-technique:**

Delphi, as it originally was introduced and practiced, tended to deal with technical topics and seek a consensus among homogeneous groups of experts. Fundamentally, the Delphi method was considered as a version of a survey analysis (Bell 1997a). With the development of the Delphi variants, the use of the method has many variations (variants: The policy Delphi, The Argument Delphi) (Turoff 1975, Kuusi 1999). The Delphi method concentrates on assessing and forecasting the future. The users of the Delphi technique aim to explore alternative future images, possibilities, their probabilities of occurrence, and their desirability by tapping into the expertise of respondents (Bell 1997a). Linstone and Turoff (1975, p. 3) characterise Delphi as a method for structuring a group communication process in such a way that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (see also Sackman 1975, Kuusi 1999, Rowe and Wright 2001, Tapio 2003). Delphi results show convergence of opinions and identify also dissent or non-convergence.

### **The future image:**

Future images are defined as mental tools which deal with possible future states and help in the the process of perceiving large and complex wholes. They are composed of a mixture of conceptions, beliefs and desires and they affect human choices and steer decision-making and actions (Rubin and Linturi 2001, p.269). Images of the future can be seen as the causes of present behaviour, as people either try to adapt to what they see coming or try to act in ways to create the future they want (Bell 1997a; see also Inayatullah 1993).

### **Scenario building:**

According to Kahn and Wiener (1967, p. 6), scenarios are hypothetical sequences of events, built with the intent of attracting attention to causal processes and points of decision. This is done in order to show how they may evolve step by step starting from the present situation. A scenario is thus an internally consistent story about the path from the present to the future. According to Van der Heijden (1996), at least two scenarios are needed to reflect uncertainty. More than four has proven organisationally impractical. Each of the scenarios must be plausible. That means that they must grow logically (in a cause-effect way) from the past and the present. Furthermore, they must be internally consistent. Events within a scenario must be related through cause-effect lines of argument which cannot

be flawed. Scenarios must also be relevant to the issues under scrutiny. In order to be challenging, scenarios must take under consideration potential surprises that may cause discontinuities in future. There are at least three methodological ways to study future; straightforward 'business-as-usual' mathematical models such as trend extrapolations, more sophisticated and policy-oriented 'what if' models that are based on econometrics and statistical information, and the studying of future prospects by gathering information from experts as views for the future to systematically develop different alternative future images or scenarios for public policy purposes with e.g. Delphi technique (Tapio 2002; see also Armstrong 2001).

### **Scenarios and strategic planning:**

At its best, the scenario approach can provide policy makers with new insights about the opportunities and risks involved in making decisions about the issues that could have major consequences in the long-term. Scenario learning also enables decision makers to break free of their conventional focus on immediate and short-term problems (Bonnett et al. 1998). Scenarios lower the level of uncertainty and raise the level of information and knowledge, in relation to the consequences of actions, which have been taken, or are going to be taken, in the present (Masini 1993, Kaivo-oja 2001). Alternative scenarios can input information in influencing the choices of strategies, in the establishment of strategic objectives and action plans, and in the evaluation of the long-term budgets (Seppälä et al. 2003).

### **The interpretation of the sustainability concept:**

The sustainability of agriculture is a stated target of agricultural policy both internationally and nationally. Within the sustainability concept, three basic elements – ecological, economic and socio-cultural – are embedded in order to provide a useful framework within which the overall impact of the resources used in the agricultural sector can be described (Yli-Viikari et al. 2002, see also Bruinsma 2003, pp. 331-356). In futures studies, a similar, broadly used approach to produce a holistic view on the future is to study topics connected to the changes in a social, technological, economic, ecological, political and in value environment (STEEPV). It is also suitable for the purpose of examining future views from the sustainability point of view. It is possible to gain a deeper insight into the studied factors with the STEEPV set, as the dimensions in a policy point of view are particularly influential and relevant (see Meristö 1991, Loveridge 1999, Van der Heijden et al. 2002).

### **Expert definition:**

According to Kuusi (1999), the method for selecting the Delphi panel is one of the most critical phases of a Delphi study. The Delphi facilitator should consider

in his/her actor analysis the most important stakeholders and interest groups, most important substance (the competence of experts) as well as the terms of delivering information in a Delphi process (information policy). The selection process of an expert panel should be done as overtly as possible. Information policies depend on three kinds of interacting factors: the personal competencies of the expert, the norms of the respondent's organisation and the organisers of foresight studies. The reason to establish an expert panel is to get the best possible information as bases for strategy preparation and subsequently strategic decisions (see also Loveridge 2002).

## **1.4 Outline of the thesis**

This thesis is divided into two parts. The Part 1 is an introduction where the context, research questions, material and methods, results and conclusions are presented and discussed. In the Part 2, the research Articles which are the basis of the thesis are presented. By means of these Articles, empirical findings are presented and discussed not just as concrete scenario narratives and future images but also at a more theoretical level as a review of the relations between strategic planning, scenario planning and the utilisation of expert information.

The thesis begins with the examination of the strategic challenges in the agricultural sector as bases for the scenario construction. To this end, a framework for interpreting strategic challenges is developed in the first paper. After this, the alternative scenario approaches, expert-based and model-based respectively, and their outcomes are presented in papers two and three. One of the main principles in the Delphi method is to show consensus and disagreed topics, therefore a comparative study was made to examine alternative future views within the agricultural sector. This is done in order to point out the divergence in future images in paper four. In this scrutiny, two interest groups were especially compared, farmers and other agri-food experts. Lastly, in paper five the linkages between the use of expert information, scenario planning and strategic planning processes were concentrated on.

## **2 Review of material and methods used**

### **2.1 The methodological base of the Articles**

In this study, empirical data was gathered following the principles of a Policy Delphi method and its latter variant Argument Delphi (Turoff 1975, p. 80, Kuusi 1999) because of their benefits in the use of long-range planning (20 to 30 years). For this timeframe, expert opinions are usually the only source of information available (Turoff 1975, p. 80, Eto 2003). Alternative future views

which are gathered through this method, contribute strongly to strategic planning envisioning the limits of future development and enabling to adapt to future challenges. Delphi as a research method has been widely used in futures studies. The users of the Delphi technique aim to predict and explore alternative future images, possibilities, their probabilities of occurrence, and their desirability by tapping the expertise of respondents (Linstone and Turoff 1975).

The following dimensions were studied within the Delphi process of this study: (1) desirable and probable future development, (2) the degree of certainty of the probable future development and (3) the importance rating of the asked variables, driving forces and changes. Furthermore, in the second round of the Delphi in some specific questions the alternative future paths and the occurrence points in time were asked. Therefore, the output of scenarios consisted of both qualitative and quantitative estimations of how future may unfold in agricultural sector within 20 years. It was also considered important that along with an expert based scenario building (through the Delphi technique) a ‘what-if’ policy model approach would enrich the expert based scenario outcomes. Therefore, in the model-based scenario building Article (III) the changes in the state of the environment, in productivity and in employment were studied among others through a quantitative model.

The bases for this thesis were that there are at least three methodological ways of studying future; straightforward ‘business-as-usual’ mathematical models such as trend extrapolations, more sophisticated and policy-oriented ‘what-if’ models that are based on econometrics and statistical information and studying future prospects by gathering information from the experts as views for the future and systematically develop different alternative future images or scenarios for public policy purposes with e.g. Delphi technique (Tapio 2002, see also Armstrong 2001). For strategic planning purposes, it is beneficial to use both model-based and expert-based approaches in parallel with each other. In this thesis, Articles I, II, IV and V represents expert oriented methodologies in scenario based strategic planning. Article III represents an alternative approach to scenario planning based on a policy-oriented ‘what-if’ modelling. The utilisation of these data is used in this Article is also presented in the following.

The first paper (Article I) presents, from an empirical point of view, three central issues closely connected to foresight studies, the strategic importance, the differences between desirable, and probable future images and the certainty estimation. Taken together these dimensions can be interpreted as strategic challenge framework (Figure 2). These dimensions were analysed with empirical Delphi data gathered from the study process. This gave the opportunity to discuss what was most important, the disagreed and probable strategic topics, and also to categorise their strategic challenge according to the panel. The respondents were asked to provide answers on the Likerts scale of one to five in the importance

and the certainty sections of the Questionnaire, with one reflecting ‘not important or certain at all’ and five reflecting ‘very important or certain’. In the future images section, the answers were asked on a scale of -2 to 2 (-2 referring to a substantial decrease from the present level, with 0 referring to no changes to the present level and 2 referring to a substantial increase from the present level). The main contribution of this Article is to present the main strategic topics facing agriculture in Finland. A Delphi study can be a feasible tool for gaining a large-scale picture of the relevant agricultural policy issues in a specific operational environment. A natural extension of reporting the topics is the creation of a more precise scenario analysis in the next step taken (Article II).

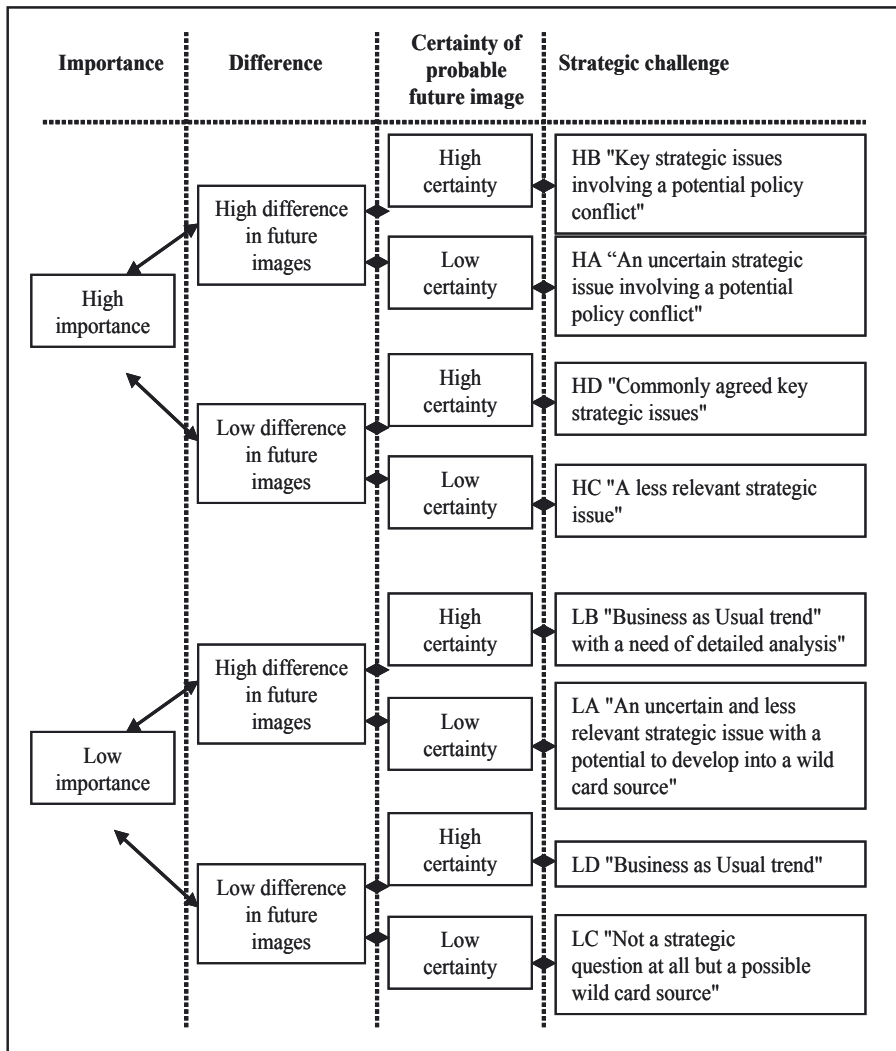


Figure 2. The dimensions in the strategic challenge framework.



In the second paper (Article II), alternative scenarios for future agriculture in Finland are presented through a Delphi study. The Delphi panel members gave their future view on desirable and probable futures. From these two dimensions, three scenarios were elaborated through the future images—the subjective future path and the importance analysis. From the empirical point of view the results from the second round were decisive in constructing the scenarios. The construction of scenarios is based on the structure on which the Delphi process was organised. The results of the different future images, the future path analysis and the occurrence points are first concentrated upon. Secondly, the analysis of the divergent views as fleshing out the scenarios and also the key premises (important unanimous views) as the basic structure for scenarios is made. Thirdly, writing of the narrative scenarios is done on the basis of these analyses. The overall time horizon and the elements of the Delphi are described in Figure 2.

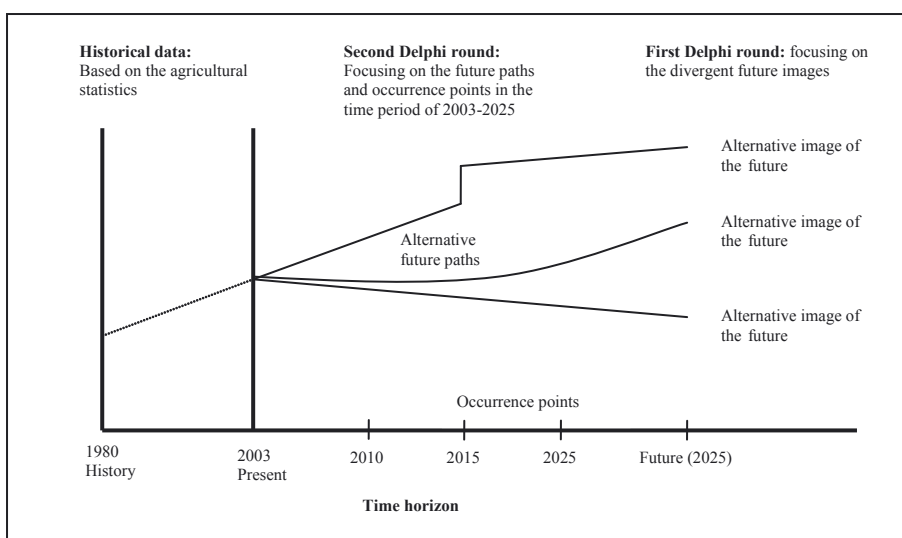


Figure 3. The time horizon and elements in the scenario process of the study.

In this paper, scenarios represent a technology optimistic ‘day-dream agriculture’, a probable future as ‘industrialised agriculture’ and an undesirable future path as ‘drifting agriculture’. Two mini-scenarios are also presented. They are based on a discontinuity event as an unexpected impact of climate change and an analogy event as an ecological breakdown due to expansive animal disease epidemics. In both mini-scenarios, the directions of storylines are dramatically changed.

In the third paper (Article III), ecological, economic and social sustainability impacts of four alternative agricultural policy scenarios are assessed which are relevant to a European perspective. The third Article is an application of a model-based scenario building. In this Article, the impacts of four alternative agri-

cultural policy scenarios are analysed and compared in quantitative terms using a set of indicators measuring changes in ecological, economic and social dimensions of sustainability. The indicator time series in alternative policy scenarios up to 2020 are calculated using an economic sector level model developed for Finnish agriculture (the DREMFA model, see Lehtonen 2001). Among the analysed alternative policy scenarios was a scenario mimicking likely effects of the on-going CAP reform of the EU (Council 2003). The other analysed scenarios were: Prolonged Agenda 2000, Integrated Rural and Environmental Policy and Liberalised Agricultural Trade. The four scenarios have been chosen based on their potential to contribute to the present Finnish dialogue as well as the European policy dialogue concerning goals and ramifications of probable and desirable developments of agricultural and rural policies, where sustainability is a pronounced policy target.

An economic agricultural sector model of Finnish agriculture is used in the evaluation of policy impacts up to 2020. Selected indicators representing the three dimensions of sustainability are calculated on the basis of the production variables of the model in each scenario. A model-based approach for scenario building is used to widen the perspective in use of future oriented information. For strategic planning purposes, it is beneficial to use both the model-based and expert-based approaches in parallel with each other. The main emphasis is on the sustainability indicator set-up and especially in the evaluation of to what extent the chosen indicators vary between the presented policy scenarios and what kind of impacts they represent in the sustainability point of view.

The fourth paper (Article IV) is based on a more traditional survey design. In this paper, the different interpretations of multifunctional agriculture were analysed by comparing the perceptions of future agriculture by the Finnish farmers and agri-food experts. This comparison data made it possible to examine concretely how and in which areas future images differ among the agricultural policy interest group. A concept of future image developed within futures studies was used for analysing the different perceptions. The empirical material was collected with a survey. In the analysis, special attention was given to the dialectics between desirable and probable futures as well as to the dis/continuities between the views of the farmer and the expert respondents. On the basis of the descriptive analysis, future challenges of agriculture were identified both in terms of opportunities and threats and their implications discussed for the multifunctionality debate. The comparison data also gave empirical evidence on the policy conflict issues among the interest groups and how they take their stands in the agricultural policy negotiations.

The study consists of empirical material collected by a survey from two separate groups: 1) farmers and 2) experts from the agri-food sector. The comparison of the perceptions of these two groups allows us to take into consideration the dif-

ferent decision-making levels from local to national level. The groups also have different positions in the decision-making structures, which evidently affect the way in which they assess the future of agriculture. A slightly different strategy was used in approaching the farmer and expert respondents. The questionnaire for the expert group included a total of 102 statements, whereas an abbreviated version with 44 statements was sent to the farmers. The reason for the weightier expert survey was that the survey also served as a starting point of the Delphi process and as it continued, further results are to be seen in Articles I, II and V. It is notable that in Article IV the results are based on the first round of the Delphi. The reason for that is that the both gathered data in the analysis of the Article IV can therefore be comparable.

The fifth paper (Article V) concludes and concentrates more on the theoretical discussion between the linkages of strategic planning, scenario planning and Delphi method giving a broad view on scenario based strategic planning in an agricultural policy planning point of view. An approach is presented in which the level of expert utilisation differs from narrow to broad participation in a public policy planning process. A basic assumption is made that in both approaches, scenarios are developed for policy support purposes. The advantages and disadvantages of these two extremes are discussed. Also one short example of how a Delphi study can contribute to scenario planning and subsequently to strategic decisions in agricultural sector is given. In this Article, the theoretical review contributes to discussions of the linkages between expert information, scenarios and strategic planning processes. The empirical part in this Article emphasises the argumentation within the expert community as a GMO example is presented. This argumentation is gathered during the Delphi process with structured interviews in which the respondents were asked to give factual arguments to back up their view on the share of GMO varieties in commercial farming.

In the following Chapters 2.1 and 2.2, two essential steps of the organised Delphi study are presented detailed: first the process of choosing the panellists and second the use of Delphi technique in the scenario building.

## **2.2 The principles in selecting Delphi expert panel**

The Delphi panel consists of wide range of agri-food experts. They represent different interest groups connected to decision-making and the development of agricultural policy in Finland. In this study, they are defined as standard stakeholders and interest groups within agricultural policy-making. Standard stakeholders comprise people who have the legitimate responsibility to participate in a policy process, for example. Standard stakeholders include the decision makers, experts, planners and analysts responsible for the preparation and management of the agricultural policy process. (see e.g. Hokkanen 1997,

Lahdelma et al. 2000). Interest groups have usually something to lose or win. Typically this group includes political parties, civil organisations, or residents of the impact area (Lahdelma et al. 2000). The reasons behind conflicting interests might be, for example, either economical, aesthetic, cultural, social or political (Hokkanen 1997). This classification of stakeholders is an indicative one but it helps in analysing and extracting results from the study.

The expert panel was chosen using a snowball technique (see Meriö 2000, Loveridge 2002). First, the criteria and classification for choosing experts were discussed and confirmed within the research group implementing the study and the preliminary panellists were listed. Secondly, the list of names was discussed at research group meetings on several occasions. Thirdly, the respondent Delphi manager (coordinator of the Delphi process) personally called on chosen experts who were selected for interview and they were also asked for further experts in their own field to take part in the postal enquiry. The list was complemented until there was a sufficient amount of expertise from the sustainability point of view in the panel. The final decision for each expert's selection was made by the responsible researcher. Generally, the Delphi method process may involve from 10 to several hundreds or even thousands of respondents in the panel (see e.g. Bell 1997a, Kuusi 1999, Angus et al. 2003, Kuusi 2003).

Kuusi (1999) argues that the method for selecting the Delphi panel is one of the most critical phases of a Delphi study. The Delphi facilitator should consider in his/her actor analysis the most important stakeholders, the most important area of expertise (the competence of the experts) as well as the terms of delivering information in a Delphi process (information policy). The selection process of an expert panel should be done as overtly as possible. An objective actor analysis should deliver not just all the key informants in the focus group of the Agri-food sector but also the most significant stakeholders in the active agricultural field. In this study, the goal of the iterative rounds was to create a wide interaction between the experts in the field of agriculture in such a way that economic, ecological and social development could be emphasised and the experts would add to well-grounded arguments to the policy discussion in future-oriented manner. The key issues to recognise in using expert panels or views are the competencies and the information policies of experts (Kuusi 1999). The information policies depend on three kinds of interacting factors: the personal areas of expertise of the expert, the norms of the respondent's organisation and the organisers of foresight studies. The reason for establishing an expert panel is to get the best possible information as bases for strategy preparation and subsequently strategic decisions (see also Loveridge 2002). The expert panel was assumed to have expertise in different dimensions of sustainable agriculture (an expert should have an economic, ecological or social perspective in their profession). Thereby, a panel consists of experts who have either specific depth or wider range of expertise in dimensions and scales of sustainable agriculture.

Furthermore, their substance knowledge had to be related to some or all of the four key categories (the STEEPV set-up) in which the experts gave their opinions of the future. For the evaluation of experts, comprehensive background information questions were asked during the Delphi process to ensure and to be able to reevaluate afterwards that the relevant substance and the stakeholders were involved in the study.

In this thesis, the future development of agriculture is based on the views that different agricultural stakeholders and interest groups have. The assumptions that are made by the agri-food experts of the agricultural development are shaping the views of those peoples who are involved with the agricultural decision making and therefore they have a direct impact on the decisions. These assumptions are based on the information and knowledge that the experts have with their experience. Therefore, this base is in continuous change as new societal changes and trends emerge and the operational environment is developing.

The respondents were also asked some additional information about their expertise, their organisational background and the experience in the first round questionnaire. According to these results the panel was divided into indicative groups to represent the variety of the participative interest groups and stakeholders. This classification was used only in the interpretation of the actual Delphi results in Article IV. The expert groups were (1) a research and development group, (2) an education and consultancy group, (3) an administration group, (4) a food industry and trade group, (5) an agricultural media group and (6) an agricultural unions and NGO's group. Therefore, it has to be kept in mind that these results represent only an expert panel view within the agri-food sector, and that Finnish agriculture is located in a region of Less Favoured Area status. So, any generalisation of the results is not adequate in the broader EU context. The results only tell us how the Finnish expert community sees the future of agriculture in the Finnish national context.

The definition of expertise and the selection process of a Delphi panel can contain pitfalls in several ways. The decision to use special experts over general experts varies in the relation to the studied target. If the research target is to evaluate the future possibilities of non-food agricultural products, for example, it is reasonable to suppose that the panel consists mainly of special experts. In fact, the more itemised the research topic is, the fewer really top experts there are to evaluate the future development. However, when the target is to evaluate the agricultural development overall taking into account the different driving forces and changes within the agri-food sector (for example, changes in a social, technological, economic, ecological, political and in value environment of agriculture) there is more need to include also general agricultural expertise into the panel. This relation between the depth and broadness of expertise (special vs. general) refers also to the quality and quantity of the consistence of a panel.

The depth and broadness of an expert information process is discussed in detail in Article V.

It can be said that the expert selection is really a case-specific question. With surveys, one usually operates with representative samples, but in the Policy or Argument Delphi one seeks specific and well defined dimensions of expertise. In the panel planning phase, at least two conditions can be evaluated: (1) How much is in stake in the study to generalise the Delphi results? And (2) how does lack or pure absence of expertise determines the capability of the panel to generate relevant future evaluations? In the first case, one should judge whether a broader panel give better evaluations of the future development. Is the target of the study defined extensively in the beginning? Furthermore, does the research object demand a broader expertise to be able to evaluate fully the relevant dimensions of the study? In the second case, where there are just a few experts in the whole nation who can evaluate future development (for example, the agricultural genetic engineering of potatoes), how extensive is it worth selecting general experts to challenge the views and argumentation of the top expertise? In this study, the goal is to evaluate several aspects and dimensions of sustainable agriculture. Therefore, the principle of a broader panel selection was adopted. The size of a panel also calls for a more structured Delphi design. This aspect is discussed in the immediately following Chapter.

## **2.3 The design of the applied Delphi and the scenario building**

The first round of the Delphi study data gathering was organised by a postal survey and by semi-structural interviews. A first round questionnaire was developed and pre-tested by the research group which implemented the study, with five experts in the agricultural field. First, eighteen experts were interviewed. Based on the pre-testing results, one measuring dimension (subjective certainty of probable future) in the questionnaire was only included in the interviews to avoid too laborious an answering in the mail survey part. Subsequently, the questionnaire was sent to 167 specialists representing different target groups as presented in Table 1. The response rate to the first round questionnaire was 54.6% overall. The structure of the first round questionnaire allowed experts to express novel questions or statements of their own, through open and free phrasing of questions. In this way, it was designed so as to ensure that the principle of an iterative specification of answers could take place.

Table 1. The participants on the expert panel.

Agri-food sector stakeholders	Total respondents (n)	Total respondents I (%)	The group response rates
Research and development	40	39.6%	80%
Education and consultancy	12	11.9%	60%
Administration	25	24.8%	40%
Food industry and trade	7	6.9%	47%
Agricultural media	8	7.9%	53%
Agricultural unions and NGO's	9	8.9%	39%
Total	101	100%	55%

The first contact with the experts to be interviewed was done with a phone call. During that call, the background and the purpose of the study was raised and the experts were asked if they wanted to participate to the Delphi process. It has to be noted that, in a Delphi process, the threshold to participate is bigger than in a conventional survey because it means at least two round of opinion exchanges and therefore more time from a single participant. However, there were no rejections from any of the proposed respondents. The questionnaire and some additional information were sent to each interviewed respondent a couple of days before the interview took place. The structured interviews lasted from one hour to four hours. The gathered data consisted of the answers to the questionnaire and of thought aloud arguments of why an expert sees the future development as such. During the interviews quick notes were written and right after the interview they were supplemented. The interviews were stored as documents awaiting further analysis.

In the following round, the first round results were interpreted as futures images and then returned to the expert panel as median futures images describing the development of the agricultural sector to get feed-back and a reevaluation of the results. Then, the revised answers were stored. Moreover, further explanation of some specific issues which emerged from the first round results was also needed. Therefore, a focused questionnaire was added to the feed-back one. The issues that needed special focus were chosen based on the rated importance and differences in both desirable and probable future images among the panellists. This focused part of the second round was organised in two separate sections—namely, (1) subjective future path analysis and (2) occurrence points in time. In the second round, the response rate was somewhat lower at 32.4%, and 16 out of the 18 interviewed experts in the first round were able to participate to the second round.

The future path analysis was done by giving a panellist a question on a certain topic where only the starting point of a specific issue was given. These included questions where statistical information was available to put into a numeric form. The panellists were asked to estimate and draw a line on the presented figure based on each one's experience and also, on the first round answers, how a specific change could occur in the future. A panellist was asked to take into consideration whether the change of a specific question was linear, expansive, declining or included discontinuities. The answers were interpreted in such a way that the margins in a question's scales were determined and, then, the answers were revised and stored. The answers were asked both as absolute and relative values. In this section also, hypothetical changes were introduced and the experts were asked to consider their occurrence points in the time period 2003-2025. In the proposed change, one was asked to estimate a desirable or probable year for this statement to occur. The panellist was also able to deny the change and give an extreme value to it according to one's viewpoint.

The construction of scenarios based on the structure on which the Delphi process was organised. Methodically, the tripartite design of constructing scenarios through the Delphi technique was following. First and foremost, it introduced a wide range of sustainable agricultural variables as future images. Secondly, in this study also the relative importance of the variables was rated by the panel. The importance analysis gave an opportunity to point out those topics that can be considered as basic premises and also those topics which represented key uncertainties according to the views of the expert panel. These results were then utilised in the scenarios. Subsequently, as a third step, together with the first round feedback questionnaire, a more detailed section was constructed for the second round to make the scenarios more profound. This was done through the occurrence points in time and a future path analysis. Also, during the first and second round interviews, the arguments for panellists' future views were gathered. This argumentation was then the basis when the scenario narratives were written. The gathered arguments were categorised according to the rationale of the scenario construction (see Article II). For example, when one argument concerning the depopulation of rural areas stated that "...the pyramid of age of rural population as such set a scene for depopulation...", the following sentence was then interpreted in the scenario storyline as follows "...depopulation and also a decrease in agricultural labour force took place in rural areas...". All in all, the extensive gathering of data gave several options to utilise in the scenario narratives.

In this study, the Delphi process included features that refer both to the Argument Delphi and more traditional survey design. This is because, in the study phase the generation of the future views were done according to a structured questionnaire, but also with several semi-structural interviews in which the factual arguments were gathered. In one of the Articles (IV) the differences



of future images were measured with a comparative survey design. This kind of a design gives also an opportunity to evaluate the fundamental differences between an Argument Delphi in which the production of factual arguments is emphasised, and a more structured survey design where the measured issues and the scale of measuring is defined long beforehand. This perspective also widens the discussions to the origins of quantitative and qualitative research. In social science, quantitative research is understood in such a way that it explores questions which can be explained by numbers and percentage values taking into account the changes and interdependencies in the studied phenomenon. Qualitative research aims to understand the research phenomenon by exploring the reasons behind its behaviour or decisions and is often characterised by a smaller amount of respondents (Heikkilä 1998, see also Toivonen 1999, Babbie 1999).

In the following, essential perspectives of the different points of view in using these two alternatives are compared. It can be said that in the planning of the questionnaire a survey-based Delphi calls for more attention in the question formulation. Delphi literature is full of warnings and descriptions of poorly formed questionnaires (Sackman 1975, Tapio 2003). If the starting point of a Delphi process is based on a survey, the handwork of generating a questionnaire must be done in such a way that double-barrelled questions, biased questions, halo effect questions or loaded questions can be avoided. This is because the measurement (survey) is usually done just by one time. This was also the case of the comparative survey in Article IV. In the Argument Delphi there is much more room in the question formulation. In fact, the first round of a Delphi can be structurally quite open; the panellists bring into the discussion the issues and information that are then the base for the second round opinion exchange. The role of a Delphi manager is in these kinds of situations more like that of an assembler. This can also be recommendable in such research problems where the level of expertise is highly specific. It is rational in these cases to leave the further formulation of the studied topics to the top expert in the field. This kind of expert based generation of research problems is generally used within futures studies and, especially, in recent Delphi studies (see for example Kuusi 2001).

When the survey design is decided, there are limited opportunities to take adaptive actions during the survey process. In a structured process, the researcher gets unambiguous answers. Therefore, the validity and the reliability of the results are also usually easier to evaluate. However, this requires that the analysis is done on statistical principles and the study design is organised according to these principles in the beginning. The basic principle of a Delphi study is structuring an iterative group communication process in which the argumentation of future views is closely related. In a survey design, this is seldom the case; it is a one-time measurement. Both in futures studies and in a strategic planning point of view, an iterative Delphi is more well-grounded, because it enables the panellists to challenge the argumentation of a differing view in an anonymous

manner. Furthermore, the presentation of new topics or approaches to the study process is much easier. In conclusion, recently the design of a Delphi process is concentrated more on expert interviews and smaller top expert panels in which the role of general experts is to challenge the arguments presented by the top expertise. This kind of process allows the deeper opinions and reasons that experts have on specific questions, to see the light of the day. The role of the general experts is also to influence the information policy of top experts, and therefore they are more probable 'forced' to reveal all of the key information they possess. This kind of pressure on panellists enables the key factual arguments to enter the Delphi results.

For successful argumentation, anonymity is one of the basic principles in the use of the Delphi method. Turoff (1975) lists several problems associated with committee processes in which the appointed group works face to face. These are (1) the domineering personality, or outspoken individual that takes over the committee process, (2) the unwillingness of individuals to take a position on an issue before all the facts are in or before it is known which way the majority is headed (3) the difficulty of publicly contradicting individuals in higher positions, (4) the unwillingness to abandon a position once it is publicly taken and (5) the fear of bringing up an uncertain idea that might turn out to be idiotic and result in a loss of face. Delphi, however, cannot be seen as a committee process. The proposition made by Turoff (1975) is that a Delphi process can be organised as a precursor to committee activity. Its goal in this function is not so much to obtain a consensus as to expose all the differing positions advocated and the principal pros and cons for those positions. In this study, the Delphi phase and the communicative phase (dissemination of results) were separate. These aspects are discussed in the conclusions Chapter.

## **3 Results**

### **3.1 The future oriented perspective for constructing an agricultural policy agenda**

New frameworks for future oriented strategic planning are needed in the agricultural sector because of the uncertainty in ecological, economic and social processes of agriculture and agricultural policy. This thesis introduces some new ideas and suggestions, as to what kinds of novel frameworks could be used in agricultural sustainability evaluation and strategic planning. The research target was multi-dimensional in order (1) to study ecological, economic and socio-cultural future views of agriculture (focusing on STEEPV set-up), (2) to focus on the changes in different spatial level, namely local, regional, national and global, (3) to focus on desirable, undesirable and probable future views,

and (4) to focus on the importance and certainty rating among the topics in the agricultural policy agenda. In this, the divergence and consensus views within the Delphi panel were especially concentrated upon.

The Articles in this study represent a future oriented way of utilising alternative scenario approaches in agricultural foresight. This gives an opportunity to consider the future of agriculture from at least five perspectives: (1) by interpreting the strategic challenges of future agriculture, (2) by presenting the alternative scenarios of future agriculture, (3) by analysing the effects of different policy scenarios on the future agriculture according the chosen sustainability indicators, (4) by comparing the future images between several agricultural interest and stakeholder groups and (5) by reviewing the use of scenario based strategic planning in which expert information and knowledge is used by the Delphi method. In the following Chapters 3.2 to 3.6 the general results of the research Articles are presented. The more in-depth results are presented in the Articles. Chapter 3.7 presents a critical evaluation of the Delphi method used in the light of this study.

## **3.2 The main strategic challenges of future agriculture**

In the first paper (Article I), a strategic challenge evaluation framework used in the interpretation of the empirical data is first and foremost presented. The evaluation framework of strategic challenges has been able to reveal strategic topics in several dimensions. Based on the expert panel data, it was argued that in agriculture and in public policy, the top five most important strategic challenges in the future were: (1) the structural changes and especially, depopulation in rural areas, (2) the profitability of agricultural production, (3) the demand for home-grown agricultural products, as well as (4) the EU's political control on agriculture. Furthermore, (5) the future agricultural support system will naturally set boundaries for agricultural production in Finland as the enlargement process of the European Union continues. The panel also emphasised new environmental technology in agriculture, managerial practices connected to quality and environmental management, as a well as the ethical principles related to agricultural production practises. In general, the changes in the agricultural production structure and the impact on environmental stress were also pointed out.

In this Article, it was also found beneficial to explore the possible wild card sources through scrutinising topics of low strategic importance, high difference between the desirable and probable future images and low certainty of the realisation of the probable future view. The topics of reevaluation in the policy agenda are presented. In these topics, two questions were above all: (1) the diversity

development caused shared concern and (2) the question of GMO plant varieties in commercial farming raises many challenges according to the panellists.

According to the results, there is causality in expert views in examined challenges. The structural changes and especially, depopulation in rural areas are seen as the major concern. This is also seen in an environmental point of view. As production concentrates regionally and the farms and cattle get bigger, local peaks in environmental loading may emerge. Therefore the managerial skills in the quality and environmental management point of view are seen essential. At the same time the farm size grows the profitability is seen increasing. However, the amount of EU based support is seen to be decreasing and, according to the panel, it should be supplemented by national measures. In order to organise an increased level of national support, the panel urges for more allowance in national decisions.

### **3.3 The expert-based scenarios for future agriculture**

After the future challenges are gone through, the next step to be made is to decide how to create the necessary structures in the scenarios according to the collected data. This will determine which data will be put in which story and how these data will be connected up. The construction of scenarios in the second expert-based paper (Article II) is based on the structure on which the Delphi process was organised. The results of the different future images, the future path analysis and the occurrence points are first concentrated upon. Secondly, the analysis of the divergent views as fleshing out the scenarios and also the key premises (important unanimous views) as the basic structure for scenarios is made according to rated importance. Thirdly, writing of the narrative scenarios is done on the basis of these analyses.

The rationale behind the constructed scenarios is based on the utopian and dystopian kind of thinking that in this study represents two extremes: desirable representing of the opportunities in the agricultural sector and undesirable future representing of the threats in the operational environment. According to Malaska (2003), utopia is generally understood as an impossible future state, but in futures studies utopia emphasises the positive elements and opportunities in society in such a way that the desired future can be achieved if we know and make the right decisions starting from today. Dystopia, on the other hand, is the opposite and includes a problematic view of the future with possibilities of several drawbacks in societal development such as environmental problems or social distortions. In this paper, the probable scenario lies between these two extremes and represents a 'business-as-usual' kind of a scenario. The analogy and discontinuity thinking has been a widely used method also within futures

studies and especially in scenario planning (see e.g. Malaska 2003, Van Notten 2005). In this paper, the meaning of an analogy event represents a situation that a once-happened crisis may emerge again in one form or another. The presentation of a discontinuity event is one which should raise the discussion of possible surprises which can have serious consequences for agricultural development.

From the above mentioned perspectives, three scenarios and two mini-scenarios were elaborated through future images and through the importance analysis. Scenarios represent a technology optimistic ‘day-dream agriculture’, a probable future as ‘industrialised agriculture’ and an undesirable future path as ‘drifting agriculture’. Mini-scenarios are based on a discontinuity event such as an unexpected impact of climate change and an analogy event such as an ecological breakdown due to expansive animal disease epidemics from where the directions of storylines are dramatically changed. The mini-scenarios emphasise the possibilities of surprises in such a way that lessons from history and emerging future challenges can be highlighted. It is notable that a multiple amount of scenarios can be constructed from the future images. What is important is that the scenarios are lying within the universe of extremities i.e. are representing the boundaries of desirable, undesirable, feasible and probable outcomes. Therefore, they can present alternatives for strategic planning in policy formulation point of view.

### **3.4 The model-based agricultural policy scenarios**

In the model-based paper (Article III) for the purposes of a policy dialogue, the sustainability of four different agricultural policy scenarios using economic modelling and selected quantitative indicators is evaluated. It seems that all four policy scenarios involve trade-offs between ecological, economic and social dimensions of sustainability. Compared to the current situation, any of the policy scenarios cannot be considered to result a better future along all the three lines of sustainability. From the policy-making perspective this is challenging because various stakeholders have conflicting views about the importance of different sustainability dimensions.

This model-based approach provides a long-term analysis of agricultural policy impacts in Finland which is a less favoured agricultural area in the EU. Investment and technical and structural change has been taken into account as an endogenous variable, which provides a deeper long-term view, *ceteris paribus*, on agricultural development than considerations, or analyses relying on exogenous technical and structural change. The analysis revealed that radical price reductions and de-coupling of agricultural support are likely to cease the positive technical change and result in decreasing production volumes in the long-term. Hence, these results indicate that in less favoured areas some pro-

duction linked subsidies are necessary, at least temporarily, if drastic declines of production are to be avoided.

### **3.5 The divergent future images between farmers and agri-food experts**

Several conclusions can be drawn from the Article IV. Firstly, both farmers' and agri-food experts' stress the need for agriculture to re-orientate its production practices in the future. They share a resilient faith in technological development and see that increasing the efficiency of the production and environmental protection are both necessary and compatible. Both of the groups also see the role of agriculture in keeping rural areas alive and inhabited as a crucial future policy question. In this respect, policy support for multi-functionalities of agriculture gets support from our respondents.

Secondly, the scale and content of the reorientation, on the contrary, raise disagreement. The analysis has revealed that the differences in the farmers' and experts' future images are the most apparent concerning the future of the farm structure. There is no agreement on what the farm structure will look like in the future. It is also obvious that farming identity and the concept of the family farm will become a more complicated issue. There is a tension between the polarisation of farms in size, geographical location, production line and income sources. This will apparently have direct effects on the sustainability of agricultural production; both in terms of ecological, economic and social impacts (see also Article III).

Thirdly, in terms of environmental impact, the structural changes may have contradictory consequences. The environmental impacts caused by large livestock farms and part-time arable farms look of course rather different. The polarisation of farms might also lead to spatial redistribution of environmental impacts, e.g., the regional concentration of livestock farms might cause an over-supply of manure in some areas and create new kinds of land-use conflicts. The problems caused by the over-supply of manure by some livestock farms and the management of the traditional biotope by some part-time sheep farms require different kinds of environmental policy instruments. The tensions between the 'polluter pays' principle and the current principle of supporting the production of environmental goods may become even more apparent in the future, if production structure and volumes are to change.

Fourthly, there are also several social risks related to the structural changes which, consequently, may affect the legitimacy of agricultural policy in future. Farmers especially tend to stress the social risks related to the changes in farm structure. In the opinion of farmers, the reorientation of production should be

carried cautiously and in a socially justified manner. There is also a fundamental uncertainty as to the future direction of the policy. Farmers' trust in the policy institutions is rather weak. The current policy institutions are not self-evidently seen as being capable of carrying out the reorientation of production. If farmers' estimations on the desirable future look so much different from the possible one, as the study suggests, the legitimacy of agricultural policy will not necessarily hold in future.

Fifth, when interpreting these results, one needs to remember that the farmers' and experts' future images are drawn from different perspectives. It can be summarised that the expert respondents, especially in the administration group, are well aware of current policy changes and the interconnections between CAP reforms, agri-environmental and rural policy goals. The expert respondents have constructed their future images as a reflection of these developments, whereas the farmers' future images reflect the daily routines of managing their own farms, optimising the relation between production, support, market prices, labour, available technology, and cultural traditions. One also has to remember that EU membership has had far-reaching impacts on the institutional structures of Finnish agricultural policy making. According to the analysis, increasing the legitimacy of agricultural policy is a key future challenge both in terms of policy practices and its impacts.

Lastly, regardless of these uncertainties felt within the policy institutions, the respondents share a resilient faith in Finnish agriculture. Both groups expect the total output of agricultural production to remain at its present level, while at the same time, they anticipate several radical changes in the operating environment of agricultural production, e.g., the long-term impact of the enlargement of the EU on Finnish agriculture and the realisation rate of genetically modified products (GMOs) in commercial farming. One could also argue that the uncertain character of the CAP has even strengthened the shared consensus, from local to national level, on the importance of domestic production. In this respect, the notion of multifunctional agriculture can be used as a rhetorical means for safeguarding the continuity of Finnish agriculture and recognising agriculture's societal value. Whether it offers paths for true reorientation remains open.

### **3.6 Linkages between the use of expert information, the scenario planning and the strategic planning**

In the fifth paper (Article V), basically two alternative ways to utilise Delphi studies in strategic planning and decision making are first and foremost pointed out: (1) a Broad Expert Information Process (BEIP) model and (2) a Narrow Expert Information Process (NEIP) model. The NEIP model can utilise Delphi technique in a conventional way, relying on expert consensus and median vo-

ter type of decision-rule. However, the participation to this process is limited. The BEIP model, on the other hand, utilises Delphi expert alternative views and arguments concerning alternative scenarios within a larger representation of interest groups. The outcome of Delphi is not only consensus results, it can also cover a wider scope of uncertainties. Relying on the NEIP model means often analysing just one scenario, whereas the BEIP model provides a broader analytical base for strategic planning and decision making.

Secondly, Delphi studies can be utilised in a flexible way to (1) find optimal strategies, (2) to provide retrospective analyses and (3) to deepen communication and information sharing in interacting processes of organisations and institutions. It is also argued that Delphi studies promote alternative approaches of strategic thinking by broadening the knowledge base. This depends, of course, on the implementation of Delphi. One can utilise alternatively a narrower or a broader way in the stakeholder involvement. In this way, Delphi studies can be used to improve the quality of public sector strategies in many ways. It is underlined that it is possible to utilise Delphi panel results in the formation of visions and policy programmes. One important point of the theoretical discussion is that scenarios can be used in testing different strategic options. Naturally, this kind of testing process helps stakeholders to improve the quality of public sector strategies.

Thirdly, a discussion and a case example concerning information output of Delphi studies are provided. As mentioned before, the key issues using expert judgements are the competencies and information policies which the experts represent. This means that in a strategy process the challenge is to filter out the best possible competence taking into account also the varying information policy that experts may have. When the competence need is well-defined and the chosen experts are properly committed to the process there will be sufficient amount of strategic intelligence for further considerations. The information generated must satisfy the needs of a scenario planning process and the needs of the players taking part in the process especially in the public sector planning process where several interest groups interact.

### **3.7 A critical evaluation of the used Delphi method**

Because the Delphi technique is the main method in this study, in the following, the sources of critics in using the method are discussed itemised. The origins of critique of the conventional Delphi based on the points that Sackman (1975) raised into the scientific discussions. It was recommended by Sackman in 1975 that conventional Delphi should be dropped from institutional, corporate and government use until its principles, methods, and fundamental applications can be experimentally established as scientifically tenable. Many of the points in



the critique focused itself only in the conventional Delphi, and the progress of the latter versions of Delphi, namely the Policy Delphi (Turoff 1975) and the Argument Delphi (Kuusi 1999) have sharpened the core essence of the technique as a scientific method. Therefore in the following, those issues raised which are still relevant in generating a successful Delphi process in the light of this study are answered according to the conclusions which Sackman (1975, p. 73) has presented.

A poor questionnaire design is the first pitfall (points 1-2 and 7, Sackman 1975, p.73). In this study, the first round of the Delphi study data gathering was organised by a postal survey and by semi-structural interviews. A first round questionnaire was developed and pre-tested by the research group that implemented the study and with five experts in the agricultural field. Based on the pre-testing results, one measuring dimension (subjective certainty of probable future) in the questionnaire was only included in the interviews to avoid too laborious answering in the mail survey part. First, 18 experts were interviewed. Subsequently, the questionnaire was sent to 167 specialists representing different agri-food interest groups. The structure of the first round questionnaire allowed experts to express new questions or statements of their own, through open and free phrasing of questions. By means of this, it was supposed to ensure that the principle of an iterative specification of answers could take place.

The second pitfall is in the use of experts and sampling (points 3-4, 6). As mentioned earlier the expert criteria for balanced panel selection were at least twofold: according to sustainability criteria and by different interest groups that have an interest to influence agricultural development. The panellists were also asked specific background questions to ensure that their expertise would meet the stated criteria. The principles and the selection process are presented and discussed detailed in Chapter 2.1.

The third pitfall is the ignorance of reliability measurement (points 5, 16). The reliability (for example, duplicated tests within the Delphi study or the comparison of the results of two similar Delphi process with different managers) is surely a benefit and can be done when organising a Delphi study. However, the reliability testing calls for parallel testing circumstances which increases the costs of the process. Furthermore, reliability testing suits rather poorly and is also questionable in the Policy or Argument Delphi where the implicit goal is an iterative, learning process in which the main idea is to find relevant arguments concerning future developments (Kuusi 1999). In these approaches, the critical step is more in the expert panel selection and especially in defining carefully the selection criteria. One original principle of Delphi technique is to be at liberty to change behaviour (a future view) during the study process. During the rounds, the argumentation of the other panellists can convince a participant to change his/her future view. In that point of view, iteration is indeed the strength of the

technique. In this, attention to the evaluation of the results must be drawn to at least two issues. First, how stable the studied phenomenon is and secondly, how stable the views of the panellists are and under what conditions they are willing to change their view.

The fourth pitfall is the aggregations of raw opinion with systematic prediction and exaggerating the precision of results (points 8 and 12). This is hardly the case in the present studies. The end-users of the Delphi study can simply benefit when the starting point is explicitly the alternative scenario representation that gives different strategic options. The evaluation of how exact the predictions are is not important in the present Delphi studies. According to Kuusi (1999), the role of Delphi experts is to make rational arguments concerning the future and therefore make possible more reasonable decisions about future development. It has to be noted that a panellist prediction can also be a proxy-argument in addition to factual arguments. In this study, the argumentation of the Delphi round is presented both by qualitative and quantitative means which allows also alternative strategic options for end-users to decide.

The fifth pitfall concerns the consensus principle (points 9 and 10) that has been redefined after Sackman's critique. In this study, the results are explicitly presented as alternative scenarios and the focus is for a start on the interpretation of the results through a strategic challenge framework which also categorises the agricultural challenges according to the difference in future views.

The sixth pitfall emphasise the lack of scientific procedures, literature of Delphi method or awareness of related techniques (points 11 and 13-14). In this, the development of the scientific use of the Delphi has progressed a lot. In fact, the second wave of a criticism in the late 1980s and early 1990s merely promoted modifications for better study design (see Tapio 2003).

The seventh pitfall concerns the ignorance of the communicating and disseminating aspect of Delphi, and the lack of face-to-face discussions of the results (point 15). In this study, the results of the Delphi process were presented in a workshop which was called a policy dialogue phase. It was organised to arrive at conclusions as to how Finnish agriculture should prepare itself for national and EU-level agricultural decision making. This policy dialogue was also organised so as to outline the roles of research among the actors in their policy preparation. In this kind of policy dialogue phase, it is also possible that individual actors and decision-makers may find themselves having similar future views and in that sense help them to establish shared strategic goals for the future.

## 4 Conclusions

In this thesis, the future agriculture in Finland was approached with several future oriented case studies and, especially, with the scenario-based strategic planning of agricultural policy. The main emphasis was on scenario development and its techniques in constructing alternative future outcomes for policy planning and preparation. The thesis began with an examination of the strategic challenges in agricultural sector as bases for the scenario construction. With this aim, a framework for interpreting strategic challenges was developed. After this, alternative scenario approaches, namely expert-based and model-based, and their outcomes were presented. As the key idea of scenarios is to present alternative future paths, a comparative study were made to examine the divergence in future images. In this scrutiny, two interest groups were especially compared, farmers and other agri-food experts. Lastly, the linkages between the use of expert information, scenario planning and strategic planning processes were concentrated upon.

In my opinion, the contribution of this thesis lies in providing (1) an evaluation framework for interpretation of strategic challenges, (2) the development in the utilisation of Delphi technique in scenario planning and concretely in the construction of scenarios, (3) the sustainability evaluation of the chosen policy scenarios according to an indicator set-up, (4) a comparative approach to evaluate the differences within the interest and stakeholder groups' future views in the agricultural policy agenda, and (5) a general review to the discussions of the linkages between the use of expert information, the scenario planning and the strategic planning processes. In the following, I will go through the Articles one by one and determine the points which are in my point of view the most significant.

There is disagreement in the study in future images, and also the importance and certainty views vary between analysed topics among the panel. This raises the question, how should a decision-maker assess the different topics from a strategic importance point of view? What are the topics one should emphasise? A topic is most likely to emerge from a decision-maker's organisation and its organisational goals and also from personal experience and a set of values.

Methodically with a strategic challenges framework, different kinds of strategic challenges can be pinpointed from a variety of different changes, variables and driving forces. In this case, the study pointed out that agricultural changes, variables and trends can be classified in such a way that their policy importance as well as the difference in opinions among the panel can be systemically represented. In my point of view, this strategic challenge framework is also applicable in other research contexts or decision-making and policy situations in identifying the key topics in the policy agenda. Among the strategic challen-

ge framework, the STEEPV set-up was a feasible tool to categorise the studied dimensions of agricultural sustainability.

When assessing the scenarios in the Article II, it is important to retrace the basic premises and key uncertainties in them. Rethinking is crucial because the assumptions of premises may change. This also concerns importance analysis. Some topics may be taken into account in a different manner if their fundamental relevancy changes. However once written, scenarios are solid bases for further use both as results and as a process learned. Because of a turbulent operational environment, it is useful to repeat the scenario process or update the assumptions and outcomes when the context changes. Also, the exercise of discontinuity or analogy event is beneficial in evaluating the limits of change.

Characteristic of Delphi studies is their long-term orientation. It is notable that the presented scenarios are not forecasts, but alternative future developments. The decisive factor for future development is the decision-making of today. Delphi can only provide potential solutions to the problems as an eye-opener of issues that can be identified and foreseen today. Delphi can contribute to the discussions of agricultural policy formation. It has to be kept in mind that these results represent only the chosen panel's view on future. The results tell us how the Finnish expert community sees the future of agriculture in the Finnish national context.

It can be said that scenarios support strategic planning by introducing not only one forecast but alternative scenarios as a basis for future decisions. They can increase organisational intelligence and preparedness to adapt changes. Knowing the boundaries of development helps orientating the occurrences of surprises and discontinuities. Scenario planning is also a good tool to foresee the surrounding trends and signals which indicate changes in the operational environment. In its entirety, it brings into discussion a strong view of the key issues which are seen as the most relevant in a decision-making point of view. The scenario approach also makes the future concrete as it describes alternative paths towards it. From the strategic planning point of view, the significance of scenarios is how they are utilised in strategy processes. That demands a lot from the scenarios. As mentioned earlier, they must be plausible, logical, internally consistent and relevant for planning purposes.

Methodically, the chosen tripartite design of constructing scenarios through the Delphi technique bring into the discussion a more comprehensive way of foreseeing the future. First and foremost, it introduces a wide range of sustainable agricultural variables as future images. Even from this point, it is possible to construct scenarios by backcasting them. Furthermore in this study also, the relative importance of the variables was rated by the panel. This dimension was considered necessary to make a strategic importance map which represented the

variables in four categories according to their importance. The importance analysis gave an opportunity to point out first, those topics that can be considered as basic premises and second, also those topics that represented key uncertainties according to the views of the expert panel. These results were then utilised in the scenarios. It has to be noted that the importance analysis is a descriptive way of categorising the examined variables but it can point out and simplify (1) what is seen important and (2) in which questions the future view is commonly shared, and in which questions there are tensions between the respondents within the topics. Subsequently, as a third step towards the construction of scenario narratives, together with the first round feedback questionnaire a more detailed section was constructed for the second round to make the scenarios more profound. This was done through the occurrence points in time and the future path analysis. All in all, it is beneficial to gather data extensively from several dimensions, because it gives several options to utilise it in the scenario narratives. Naturally, the strategy for the required data has to be determined carefully beforehand.

The model-based scenarios provide an elaborated example of how to make a systematic assessment of changes taking place in alternative policy scenarios with the help of selected indicators. As the results show, some of the main indicators are conceivable and their interpretation is clear. Still, inevitably there remain gaps in the coverage and interpretation of the selected indicators. Despite this, the analysis can help decision-makers initiate a policy dialogue about the likely sustainability impacts of the alternative agricultural policy scenarios. After all, indicators represent a balanced way to examine the sustainability of different policy scenarios. With this scrutiny, an indicative ranking can be made according to the sustainability of the scenarios and the trade-offs between alternative scenarios can be pointed out and discussed.

When assessing the feasibility and usability of the results, one can conclude that there are logical and conceivable causal relationships between the specific indicators. The economic rationality, reflected by changes in animal units and land use, and caused by changes in relative profitability between different products and production lines, is seen as a primary driving force behind agricultural development. From this perspective, ecological and social objectives play a lesser role — they are subordinated to economic incentives of decision making. Even though this point of view is somewhat simplistic (farmers may have also other objectives than profit maximisation), it is essentially this simplification which provides a clear logic in evaluating changes in different dimensions of sustainability.

As mentioned earlier, the future challenges can be studied both based on the expert future views (Delphi technique) and on the basis of a ‘what-if’ policy model. These both approaches have been widely used in the futures studies and a simultaneous utilisation can be beneficial (see Armstrong 2001). From a strate-

gic planning point of view, the use of the approaches is instrumental; the results as strategic options have to be exposed to the stakeholders and interest groups and therefore, test the significance of the results and furthermore, the methods. Both of the approaches must produce policy relevant information as a base for decision-making in order to be profitable. In my opinion, it is useful to organise a policy dialogue process which can be used as a forum to test primarily the results of the methods and their relevance to contribute to the strategic planning. A secondary goal in the strategic planning point of view is more scientific; to test the methods for generating the information and knowledge base in such a way that the methodology can improve.

Examining future images between farmers and various agri-food experts gives an opportunity to evaluate future questions in the agricultural policy agenda that are commonly shared goals or which can raise disagreement and perhaps policy conflict situations. This scrutiny helps to evaluate the legitimacy of agricultural policy planning and outcomes, because it brings to the table the different views of future among the relevant interest groups and stakeholders. The close linkages between policy process and futures research are necessary to guarantee the policy relevance of the results. This can, in fact, be understood as the core of futures studies: its very purpose is to bring together and enhance dialogue between different stakeholders in order to facilitate planning and decision-making in a future-oriented way. This requires capabilities for critical self-reflection from all parties within the agri-food chain.

In the last paper, a broad view on scenario-based strategic planning is opened up. An approach in which the level of expert utilisation differs from narrow to broad participation in a public policy planning process is presented. This theoretical review contributes to discussions of the linkages between expert information, scenarios and strategic planning processes. All in all, the key principle in generating alternative scenarios is that it must satisfy both the needs of a scenario planning process and the needs of the players taking part in the process especially in the public sector planning process where several interest groups interact.

A consensus seeking is seldom a primary goal in the study phase; it is matter of strategic decision-making and strongly related to the end-users of the results. From the strategic planning point of view the Delphi technique has instrumental value in providing different alternative futures and the argumentation of each scenario. However, a Delphi study phase can be seen as part of a strategic process and during the rounds one strategic option can be argued and therefore chosen from among the alternatives. This refers to the concept of commitment reasonability (Kuusi 1999, p. 117). The idea is to build reasonable coalitions of actors for realising future options. In this kind of study design, it is clear that a Delphi panel has received an assignment where a recommendation in a form of a strategic plan is expected. If the goal is more in the anticipation of the ac-

tions of relevant actors, without a voting purpose of winning option (winning arguments), then Kuusi (1999) categorises it as predictive reasonability. In this option reasonability, the focus of a Delphi study is to obtain arguments and judgements which are important and valid at least for some actors represented within the panel. From the strategic planning point of view, the Delphi technique has instrumental value in providing different alternative futures and the argumentation of each scenario or future image. This agri-food Delphi study refers mostly on the approach of option reasonability. In this, the challenge of a Delphi manager is to disseminate the results in a balanced manner.

A considerable additional value of this kind of Delphi process is that a single panellist can reflect his/her opinions as an iterative, learning process and, in that sense, it may contribute to achieving a more common vision within the actors in the food chain. At the very least, it increases the consciousness of differing views and their arguments on future among the participative panellists. This is also the matter of a question as to how the results are introduced when they have been finalised. In this study after the Delphi rounds, the results were presented in a future workshop together with several other future oriented studies in the field. This future workshop, which was called a policy dialogue phase, was organised to arrive at conclusions as to how Finnish agriculture should prepare itself for national and EU-level agricultural decision making. This policy dialogue was also organised so as to outline the roles of research among the actors in their policy preparation.

## **Future research**

This thesis concentrated on the utilisation of alternative scenario approaches in defining the policy agenda for future agriculture in Finland. From my point of view, there is a need for further theoretical studies about the linkages between expert techniques, scenario building and strategic planning practises. Also, there is a need to explore the relationship between futures studies and strategic management. In my opinion in this exploration, scenario building can be a connective approach for further definitions, and thereby contribute more to the theoretical development in both of them.

As described in the first Article, public sector strategic planning is always a balancing act between consensus and dissension within the various strategic topics. In this respect, there is always room for a trade-off between topics on policy agenda. Therefore, a more careful interest group analysis, for example on the basis of the Delphi technique panel, could be useful for further policy analysis needs. In this, the key point could be in understanding the fundamental roles and the weights of different interest groups and stakeholders within the planning of agricultural policy.

This thesis concentrates on the general evaluation of the agricultural development taking into account the several dimensions that agriculture represents. The sustainability dimensions of agriculture, namely ecological, economic and socio-cultural, were the starting point in early phase of the study. The generality in this approach also raises the question that in the future more focused future-oriented studies for example in the form of case studies could be launched. In such a way one can get deeper insight of a particular policy-relevant theme. There are several themes that can be concentrated on such as the utilisation of bio- and gene technology or the future possibilities of renewal energy sources in agriculture. These kinds of more in-depth studies can contribute to policy planning delivering alternatives and strategic options for future decisions in particular cases.

As mentioned, written scenarios are solid bases for further use both as results and as a process learned. Because of the continuous changes in the operational environment, rethinking is crucial as the premises change equally. Therefore, it would be useful to repeat the scenario process or update the assumptions and outcomes when the context changes. Also, in the way how the Delphi design was used in this study, it would be interesting to repeat it every five years' time and thereby re-scan the change in focuses in the policy agenda.

It is possible and also desirable to use both model-based and expert-based methods in the construction of policy-relevant scenarios for planning purposes. At the very least, these approaches and their outcomes can be utilised, for example, in the policy dialogue phase. When the results of both approaches are exposed to the evaluation of planners and decision-makers it also raises questions of the basic assumptions that the both methods include in their procedures. In this way, the methodology can be improved with the help of feedback information. In this kind of policy dialogue phase, it is also possible that individual actors may find themselves having similar future views, and in that sense, it help them to establish shared strategic goals for the future. Therefore, the prize of the predisposed scenarios is twofold: the outcome as scenarios contributes to the strategic planning and the methods for generating the information and knowledge base improve.

A methodically interesting aspect would be also to compare the design and results of model-based scenarios and expert-based scenarios in such a way that the comparison could be done within the assumptions that drives the model and the assumptions that the expert community shares. This could be further analysed according to the results of alternative approaches by examining the similarities and differences in them. This kind of scrutiny can also be relevant when the model-based and expert based scenario approach is used in parallel with each other. Expert-based and more qualitative information can complement the information provided by the quantitative model-based approach and vice versa.



# Summary

## Empirical findings:

- Based on the expert panel data, it was argued that the most important strategic challenges in the future will be: (1) the structural changes and especially, depopulation in rural areas, (2) the profitability of agricultural production, (3) the demand for home-grown agricultural products, as well as (4) the EU's political control on agriculture. Furthermore, (5) the future agricultural support system will, naturally, set boundaries for agricultural production in Finland as the enlargement process of the European Union continues.
- The Delphi results indicate that the regional concentration of agricultural production continues. In southern and western parts of Finland, there is just a slight decrease in total cultivated area. In eastern and northern parts, the change is more dramatic. Even the median alternative indicates that the cultivated area can drop to half in these areas. The total amount of agricultural production (arable crops and livestock production) seems to decrease, but only fractionally. Also, fewer farms will exist as the panel expects that the number of farms will halve by 2016. It seems rather certain that genetically modified (GMO) varieties will enter the commercial farming in Finland from 2010 up to 2012 at the latest. In general, the expert panel had a strong faith in technological development and in technological innovations.
- The 'what if' model-based analysis revealed that radical price reductions and de-coupling of agricultural support are likely to cease positive technical change and result in decreasing production volumes in the long-term. Hence, these results indicate that in less favoured areas some production linked subsidies are necessary, at least temporarily, if drastic declines of production are to be avoided.
- The farmer and agri-food expert panels share a resilient faith in technological development and see that increasing the efficiency of the production and environmental protection are both necessary and compatible. Both of the groups also see the role of agriculture in keeping rural areas vivid and inhabited as a crucial future policy question.
- The differences in the farmers' and experts' future images are the most apparent concerning the future of the farm structure. There is no agreement on what the farm structure will look like in the future. It is also obvious that farming identity and the concept of the family farm will become a more complicated issue. There is a tension between the polarisation of farms in size, geographical location, production line, and income sources. This will apparently have direct effects on the sustainability of agricultural production, both in terms of ecological, economic and social impacts.

## **Methodological and scientific findings:**

- The evaluation framework of strategic challenges has been able to reveal strategic topics in several dimensions. It has addressed the areas of consensus and areas of disagreement and uncertainty. In our study the disagreement, importance and certainty views vary between analysed topics among the panel. The main contribution of this study is in the systematic development of the strategic challenge framework.
- The chosen tripartite design of constructing scenarios through the Delphi technique brings into the discussion a more comprehensive way of foreseeing the future. First and foremost, it introduces a wide range of sustainable agricultural variables as future images. Furthermore, in this study also the relative importance of the changes, variables and trends was rated by the panel. The importance analysis gave an opportunity to point out first those topics which can be considered as basic premises and also those topics which represented key uncertainties according to the views of the expert panel. Subsequently, as a third step towards the construction of scenario narratives, together with the first round feedback questionnaire, a more detailed section was constructed for the second round to make the scenarios more profound. This was done through the occurrence points in time and the future path analysis.
- It is possible to utilise Delphi panel results in the formation of visions and policy programmes alternatively through a Narrow Expert Information Process or a Broad Expert Information Process. The depth of the expertise and the broadness of the participating interest groups and stakeholders is the key question. The scenarios that are constructed with these alternative ways can be used in testing different strategic options. This kind of testing process helps stakeholders to improve the quality of public sector strategies.

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## Appendix 1 (1/9). First round questionnaire

This appendix represents a translated version of the first round questionnaire in the Delphi study. Some of the aspects in the questionnaire have not been used in this thesis. These include the section five ‘statements on interaction of agricultural change factors’ and most of the section six ‘background information’. These sections are reported in Rikkonen (2003).

-TRANSLATED -

### Dear expert of the Agri-food chain,

The discussion on the future of agriculture and, more broadly, the whole agri-food chain, is now underway in many fora. Different national and international change factors, such as genetic engineering or the EU's eastern enlargement, will form the operational environment of agriculture, rural areas and food production in the next decades. Thus, one requires research knowledge to support this decision-making, and different experts should work together in estimating the long-term future aspects of agriculture. This study utilises the results of the ongoing project "The Future of the Food Industry - ETU 2030".

This part of the enquiry is carried out as an informed survey. This questionnaire enquires from a large group of experts their views on agriculture over the next 25 years. The survey includes four topics:

1. Changes in physical environment of farms and surrounding nature
2. Changes in agricultural technology and future competencies
3. Changes in agricultural institutions and policy
4. Changes in agricultural commodity market.

This survey relates to a project in the Academy of Finland's research programme Sustainable Use of Natural Resources<sup>1</sup> which studies the future choices of Finnish agriculture, and the dimensions and levels of sustainability. Further information on the project is to be found at <http://www.vyh.fi/tutkimus/maametsa/susagfu/susagfus.htm>. The survey includes two rounds, the latter of which is organised at the end of 2002. I would hope that you could take part in the discussion on both rounds. The responses to both rounds will be handled in confidence, and the answers of any single respondent are not revealed from the data.

Yours sincerely,

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<sup>1</sup> The research programme on Sustainable Use of Natural Resources (Sunare) aims at producing research knowledge to improve decision-making on natural resources, developing multi-disciplinary research on the sustainable use of natural resources, enhancing the dissemination of research results from the researchers to the users of research results, creating new national and international contacts in the research on sustainable use of natural resources, and to improving and diversifying the use and nurturing of natural resources. Further information is to be found at <http://www.sunare.helsinki.fi/>



## Appendix 1 (2/9).

### *Expert views on future agriculture*

Please evaluate the changes to Finnish agriculture over the next 25 years from your point of view. Circle the opinion which matches your viewpoint in the case of each change factor. Evaluate **(item 1) how would you wish** the change factor to develop (desirable change), and **(item 2) how the development probably** will proceed. Consider the question in relation to the importance of the change factor, or to its quantity, if it will increase or decrease. If you cannot or do not wish comment on the question, please draw a line across the response alternatives of the question. The alternatives are seen in the example below. Consider the change in a perspective of 25 years in Finland, if no other period or region is mentioned in the question.

Please evaluate also **(item 3) how certain you are** that the change mentioned in item 2 will be realised, and **(item 4) how important you consider** this change factor or change from the point of view of the future of Finnish agriculture.

#### EXAMPLE:

Change factor	1. Desirable change	2. Probable change	3. Certainty of the probable change	4. Importance of change factor
	-2=decreases considerably -1=decreases 0=stays unchanged 1=increases 2=increases considerably		1=extremely uncertain 2=uncertain 3=fifty-fifty chance 4=quite certain 5=extremely certain	1=not important at all    5=extremely important
1. Number of unoccupied tractors controlled by satellite positioning system in managing field work by year 2025.	-2 -1 0 1 <b>2</b>	-2 -1 <b>0</b> 1 2	1 2 3 4 <b>5</b>	1 <b>2</b> 3 4 5

Response example:

**On items 1 and 2** this response means that you wish the number of unattended tractors controlled by satellite positioning system to increase considerably from the current level, but you do not consider this increase very probable, but, in your opinion, it will stay the same (at zero level) in the future.

*On items 3 and 4* you think that it is extremely probable that the change you consider the most probable will be realised. You see that the change factor (unoccupied tractors) is not important for the Finnish agriculture in the 25-year perspective.

## Appendix 1 (3/9).

### 1. Changes in physical environment of farms and surrounding nature until 2025

Change	1. Desirable change	2. Probable change	3. Certainty of the probable change	4. Importance of change factor
	-2=decreases considerably -1=decreases 0=stays unchanged 1=increases 2=increases considerably		1=extremely uncertain 2=uncertain 3=fifty-fifty chance 4=quite certain 5=extremely certain	1=not important at all    5=extremely important
1. Total cultivated field area	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
2. Amount of afforestable field area in Eastern and Northern Finland	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
3. Amount of afforestable field area in Southern and Western Finland	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
4. Diversity of agricultural landscape (number of land use types in relation to area examined)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
5. Climate load coming from agriculture (greenhouse gases)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
6. Use of fertilizers	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
7. Nitrogen load from agriculture	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
8. Phosphorus load from agriculture	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
9. Environmental hazards caused by agricultural production practices (for example, storing of manure or lack of buffer zones)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
10. Regional concentration of agricultural production sectors	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
11. Diversity of flora and fauna surrounding farm	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
12. Depopulation of rural areas	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
13. Occurrences of animal diseases harmful to humans in Finland	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
14. Measures to decrease load of the water system (field edges, buffer zones, wetlands, etc.)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
15. Total use of chemical pesticides in agriculture	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
16. Erosion of cultivated soil (for example, loss of topsoil humus)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
17. Size of farms and number of animals per farm	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5

## Appendix 1 (4/9).

### 2. Changes in agricultural technology and know-how

Change	1. Desirable change	2. Probable change	3. Certainty of the probable change	4. Importance of change factor
	-2=decreases considerably -1=decreases 0=stays unchanged 1=increases 2=increases considerably		1=extremely uncertain 2=uncertain 3=fifty-fifty chance 4=quite certain 5=extremely certain	1=not important at all    5=extremely important
1. Systematic management of farm activities (managerial competence)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
2. Trading agricultural production (harvest) over the Internet	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
3. Innovations of environmental technology in managing harmful environmental effects ( <i>inter alia</i> , nutrient load and methane emissions)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
4. Data networks in farmers' local co-operation and farmers' enterprise networks	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
5. Utilisation and implementation of newest production technology on farms	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
6. Number of unattended tractors controlled by satellite positioning system in managing field work	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
7. Biotechnological processes and products in food production	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
8. Number of genetically modified crops/plants in Finland	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
9. Number of local agricultural contract chains and enterprises in harvesting domestic plants	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
10. Automation technology in animal husbandry	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
11. Automation technology in plant production	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
12. Producing the energy farms need from renewable natural sources in farms' own production facilities	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
13. Importance of information and communications technology in cultivation measures during growing season	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
14. Importance of precision production techniques	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
15. Farmers' ethical attitudes	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
16. Number of skilled farm employees in labour market	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
17. Implementation of alternative tilling methods (for example, reduced tillage, no-till)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5

## Appendix 1 (5/9).

### 3. Changes in agricultural institutions and policy

Change	1. Desirable change	2. Probable change	3. Certainty of the probable change	4. Importance of change factor
	-2=decreases considerably -1=decreases 0=stays unchanged 1=increases 2=increases considerably		1=extremely uncertain 2=uncertain 3=fifty-fifty chance 4=quite certain 5=extremely certain	1=not important at all    5=extremely important
1. EU's political control on agricultural and rural development issues	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
2. Directing subsidies within agricultural policy towards production lines which generate less greenhouse gases	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
3. Voluntary environmental measures on farms	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
4. Regional enterprise networks supporting further processing of agricultural products	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
5. Shifting focus of EU's agricultural policy back to national policy and decision-making power	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
6. Amount of subsidies for public goods produced by rural environment and nature in EU (subsidy policy in developing villages, in cultural landscape)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
7. Control and legislation related to agri-environmental issues	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
8. Political support for organic farming	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
9. Limitations of output ( <i>inter alia</i> , country-specific production quotas)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
10. Input of civic organisations to agricultural policy	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
11. Integration of administration of agriculture and forestry sector and environmental sector	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
12. Ethical reporting on agricultural production	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
13. Importance of agriculture in developing rural areas and their vitality	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
14. Industrialised agricultural production structure in Finland	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
15. Risk assessment of genetically modified food	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
16. Share of environmental aims in EU's common agricultural policy	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
17. Rural policy aims in agricultural policy	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5

## Appendix 1 (6/9).

### 4. Changes in agricultural commodity market

Change	1. Desirable change	2. Probable change	3. Certainty of the probable change	4. Importance of change factor
	-2=decreases considerably -1=decreases 0=stays unchanged 1=increases 2=increases considerably		1=extremely uncertain 2=uncertain 3=fifty-fifty chance 4=quite certain 5=extremely certain	1=not important at all    5=extremely important
1. Importance of crop/plant production in Finnish agriculture	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
2. Importance of milk production in Finnish agriculture	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
3. Importance of beef and pork production in Finnish agriculture	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
4. Agriculture's GDP share in Finnish national economy	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
5. Demand for genetically modified food	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
6. Certified food products (food production and products verified with farm's quality and environmental system)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
7. Share of additional income in farmer's income formation	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
8. Producers' input into production methods that are more hygienic, safer and increase animal well-being	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
9. Importance of rural tourism and nature-based enterprises on rural areas	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
10. Producing environmental information on agricultural production for interest groups and consumers ( <i>inter alia</i> , environmental reporting)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
11. Demand for foreign food products	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
12. Demand for domestic food products	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
13. Use of fast food	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
14. Effect of research results on consumers' food purchase decisions ( <i>inter alia</i> , healthy and safe food products)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
15. Share of organic food in consumers' daily food purchases (demand for organic food)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
16. Share of local food in consumers' daily food purchases (demand for local food)	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
17. Demand for functional food products	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
18. Export of organic products	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
19. Export of total agricultural production	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5

## Appendix 1 (7/9).

Change	1. Desirable change	2. Probable change	3. Probability of change	4. Importance of change factor
	-2=decreases considerably -1=decreases 0=stays unchanged 1=increases 2=increases considerably		1=extremely uncertain 2=uncertain 3=fifty-fifty chance 4=quite certain 5=extremely certain	1=not important at all    5=extremely important
20. Share of imported food products in Finnish market	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
21. Epidemic diseases originating from food products that are directed at humans	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
22. Share of agricultural subsidies in farmer's income formation	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
23. Amount of EU's agricultural subsidies in Finland when the agricultural production of Central and Eastern Europe shifts to EU's internal market	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
24. Amount of national agricultural subsidies in Finland when the agricultural production of Central and Eastern Europe shifts to EU's internal market	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
25. Consumers' negative attitude towards agricultural subsidies	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
26. Amount of farm enterprise investments	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5
27. Profitability of farm enterprises	-2 -1 0 1 2	-2 -1 0 1 2	1 2 3 4 5	1 2 3 4 5

- The effect of the following issue(s) should be added to the questions concerning the future of agriculture:

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- In my opinion, the most important effect/change factor concerning the future of agriculture is/will be

Regionally: \_\_\_\_\_  
 Nationally: \_\_\_\_\_  
 Globally: \_\_\_\_\_

- Other comments, additions and corrections to the questions on the future of agriculture:

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## Appendix 1 (8/9).

### 5. Statements on interaction of agricultural change factors

Please respond next to some statements concerning the future of agriculture. Consider the development of agriculture in the next 25 years. The response alternatives are seen below.

Statement	-2=totally disagree -1=somewhat disagree 0=cannot say 1=somewhat agree 2=totally agree
1. Climate change should be taken into consideration in agricultural policy-making over the next 25 years.	-2 -1 0 1 2
2. A part of the field crop production will shift from Finland to economically more viable farming areas within the EU.	-2 -1 0 1 2
3. Farm's form of enterprise will change from family farming to industrialised companies and groups of many farms.	-2 -1 0 1 2
4. Technological development will polarise agriculture, on one hand, to large high-tech farms and, on the other hand, to alternative, environmentally friendly, ethically-functioning small farms.	-2 -1 0 1 2
5. Some professional farmers will transfer to Central and Eastern European countries to develop their food production.	-2 -1 0 1 2
6. The fragmentation of farmer's work (many different sources of income) will cause serious problems in the quality and safety of food production.	-2 -1 0 1 2
7. Neighbouring countries of Central and Eastern Europe (Baltic countries and Poland) will occupy a large portion of agricultural food market in Finland.	-2 -1 0 1 2
8. The governmental monitoring on agricultural subsidies will be tightened within the EU.	-2 -1 0 1 2
9. The liberalisation of world market will decrease Finnish agricultural production.	-2 -1 0 1 2
10. The quality and traceability problems of food products will cause a lot of trouble in the domestic market.	-2 -1 0 1 2
11. Food product packages will include producing farm's line-specific "environmental product description" which describes the environmental principles of farm operation and production.	-2 -1 0 1 2
12. Consumers' negative attitude towards intensive industrial production will increase.	-2 -1 0 1 2
13. Agricultural subsidies will be paid in the future on the basis of amount produced.	-2 -1 0 1 2
14. Agricultural income per farm will decrease in Finland.	-2 -1 0 1 2
15. The role of the public sector will increase in practising regional policy on developing rural areas.	-2 -1 0 1 2
16. The production environment and well-being of animals on farms will be regularly evaluated by independent external evaluating methods.	-2 -1 0 1 2
17. The implementation on the agricultural subsidy system will shift from the national level to regional level in the future.	-2 -1 0 1 2
18. The amounts of hormones used in animal husbandry will increase in Finland in order to gain more output.	-2 -1 0 1 2

## Appendix 1 (9/9).

### **6. Background information**

**1. Gender**

1. Male
2. Female

**2. Year of birth** \_\_\_\_\_

**3. Region of residence**

1. Southern Finland
2. Eastern Finland
3. Western Finland
4. Northern Finland

**4. Place of residence**

1. Metropolitan area
2. Other town
2. Other population centre
3. Rural area

**5. Educational background**

1. Sciences
2. Social sciences
3. Economic
4. Technical
5. Other, which? \_\_\_\_\_

**6. Degree**

1. College-level or vocational degree
2. Polytechnic, lower university degree
3. Higher university degree
4. Licentiate or Doctoral degree
5. Other \_\_\_\_\_

**7. I've been working for the past (years)**

1. 1-5 years
2. 5-15 years
3. 15-25 years
4. more than 25 years

**8. According to my work and field of expertise, I belong to the following expert group:**

1. Research
2. Education and guidance
3. Administration
4. Enterprise/industry/trade
5. Media/public relations
6. Interest group and civic organisation
7. Other, which? \_\_\_\_\_

**9. The majority of my work tasks relate to**

1. Local
2. Regional
3. National
4. International issues.

**10. I participate in work concerning agriculture and rural areas (for example, decision-making, preparation, informing, development or research)**

1. Daily
2. Weekly
3. Monthly
4. Once a year
5. I don't participate

**11. In my own words, my core know-how is**

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**12. In my opinion, answering this questionnaire was**

1. Extremely easy
2. Quite easy
3. Quite hard
4. Extremely hard

***Thank you for participating in this survey!***



## Appendix 2 (1/2). Second round questionnaire

This appendix represents a translated version of the parts 1 and 2 of the second round of the Delphi study. Overall, the second round Delphi questionnaire consisted of three parts: 1) evaluation of the occurrence points in time, 2) the future path analysis, and 3) the feedback report from the first round results presented as future images. In the third part, the first round future images were fed back to the panellists and an opportunity was given to change their first round answers. Panellists were also asked for further arguments if they wanted to change the first round answer. The future images and the argumentation are available in Rikkonen (2003).

- TRANSLATED -

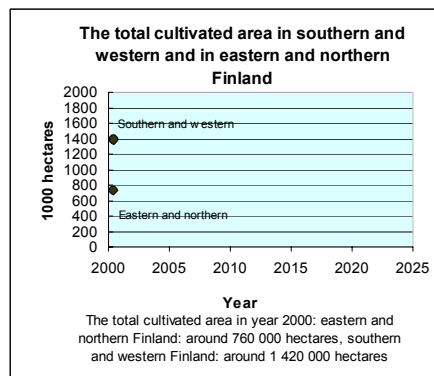
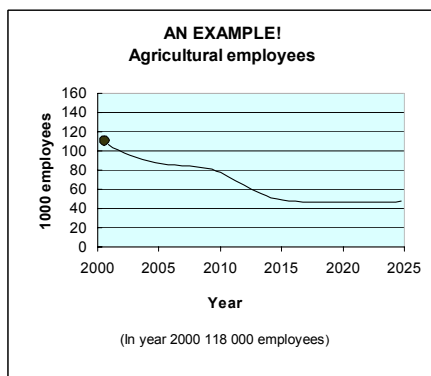
### Part 1: Evaluation of the occurrence points in time

**Instructions for answering:** Evaluate the occurrence point in time of presented changes in Finland according to 1) *desirable* and 2) *probable* realisation of the stated question. Mark your answer by writing your opinion of the estimated year to the time frame 2003-2025. If you consider that the proposed percentage is unachievable in questions 1-7, please, mark a cross (x) to the place "does not occur". In that case, please, write down your probable view of the extreme percentage (either increasing or decreasing value from the given value) to the right column.

		2003	2005	2010	2015	2020	2025	Does	Extreme
								not occur	value
1. The national support will be 70% (in 2001, 59.5%)	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
2. The production of bread and fodder cereals decreases 25% (in 2001, 3,626 billion kilos)	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
3. The combined beef and pigmeat production decreases 25% (in 2001, 265 million kilos)	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
4. The number of farms halves from the 2000 level (in 2000, approximately 78,000)	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
5. The food industry owns over one third of the total agricultural land	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
6. Nutrient load (phosphorus and nitrogen) on waters halves from the present level	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
7. Endangered species in agricultural environment (cultural landscape) increase some 25% (in 2000 420 endangered species)	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
8. The first genetically modified plant variety in commercial farming	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----
9. Agricultural production quotas are withdrawn	desirable	-----	-----	-----	-----	-----	-----	---	-----
	probable	-----	-----	-----	-----	-----	-----	---	-----

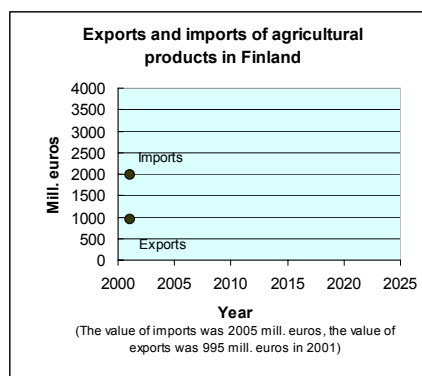
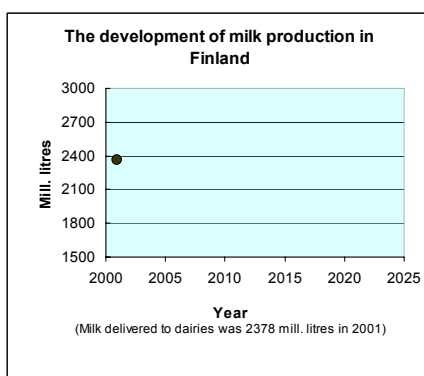
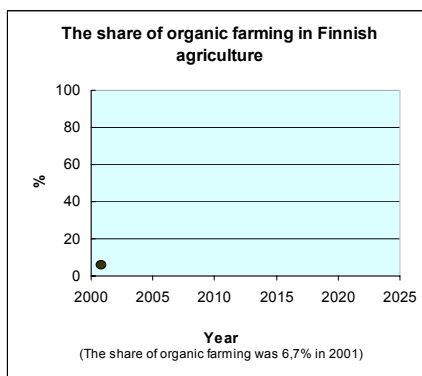
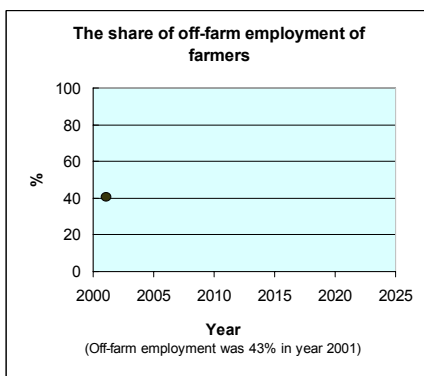
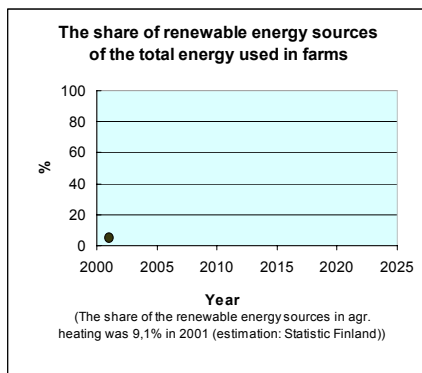
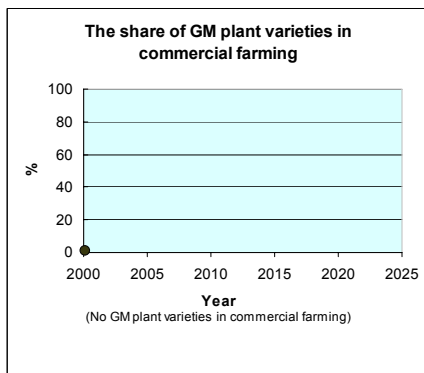
### Part 2: The future path analysis

**Instructions for answering:** Evaluate by drawing to the figure your view on, how the proposed questions will evolve from the given initial value till 2025. While drawing your estimation, please, consider whether the change is linear, strengthening and accelerating, quickly growing or does the change reverse on the given time scale. The initial value is given (marked as circle). Evaluate only the *probable* change in Finland.



## Appendix 2 (2/2).

- TRANSLATED -



## Appendix 3 (1/1). Participating organisations in Delphi study

- Aamulehti (a newspaper)
- Aluekehityssäätiö (a foundation for regional development)
- Animalia – Federation for the Protection of Animals
- Atria Ltd
- A-Tuottajat Ltd
- Birdlife Finland
- Central Union of Agricultural Producers and Forest Owners (MTK), (various local departments)
- Centre of Expertise for the Food Processing Industry, ELO
- Employment and Economic Development Centre for South Ostrobothnia
- Employment and economic development centre for Varsinais-Suomi
- ETLA, the Research Institute of the Finnish Economy
- Fin-Auguuri Ltd
- Finfood - Finnish Food Information Service
- Finnish Environment Institute
- Finnish Game and Fisheries Research Institute
- Finnish Food and Drink Industries' Federation
- Finnish Regional Research (FAR)
- Foodwest Ltd
- Friends of the Earth, Finland
- Gallup Food and Farm Facts
- Government Institute for Economic Research (VATT)
- Helsinki School of Economics
- Helsingin Sanomat (a newspaper)
- Hk-Ruokatalo Ltd
- Iisalmen sanomat (a newspaper)
- Imajoki School of Agriculture
- Kesko Corporation
- Kuluttajat-Konsumenterna ('The Consumers')
- Lammin säästöpankki
- Luomuliitto (a registered association of organic farming)
- Maaseudun tulevaisuus (a newspaper)
- The Martha Organization
- Ministry of Agriculture and Forestry, various departments
- Ministry of the Environment
- Ministry for Foreign Affairs
- Ministry of Finance
- Ministry of the Interior
- Ministry of Trade and Industry
- MTT Agrifood Research Finland
- National Consumer Research Centre
- Pellervo Economic Research Institute PTT
- Pohjanmaan vesiensuojeluyhdistys ry. (a registered association of water protection in Ostrobothnia)
- ProAgria Farma - Rural Development Center
- ProAgria Group
- Pyhäjärvi Institute
- Regional Council of South Ostrobothnia
- Regional Council of Southwest Finland
- Rural Women's Advisory Organisation
- Savon Sanomat (a newspaper)
- Southwest Finland Regional Environment Centre
- South Ostrobothnia Rural Advisory Centre
- Statistics Finland
- Suomen rehu Ltd
- Svenska Landbruksproducenternas Centralförbund, SLC
- Swedish School of Social Science
- University of Helsinki, Aleksanteri Institute
- University of Helsinki, Institute for Rural Research and Training Mikkeli Unit
- University of Helsinki, various departments
- University of Joensuu
- University of Jyväskylä
- University of Oulu, regional development unit of Kajaani
- University of Tampere
- University of Turku
- The Village Action Association of Finland
- VTT Technical Research Centre of Finland
- West Finland Regional Environment Centre
- WWF
- Yleisradio
- Ylistaro municipality
- Österbottens svenska producentförbund

## **Agrifood Research Reports of MTT Economic Research**

- No 14 Karttunen, J., Mattila, P., Myyrä, S. & Uusitalo, P. 2002. Esteiden aiheuttamien haittojen arvo peltoviljelyssä. 59 s., 5 liitettä.
- No 16 Risku-Norja, H., Mäenpää, I., Koikkalainen, K., Rikkonen, P. & Vanhala, P. 2002. Maatalouden materiaali- ja energiavirrat, ekotehokkuus ja ravinnontuotannon kestävä kilpailukyky. 61 s., 4 liitettä.
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- No 56 Knuutila, M. 2004. Elintarvikesektorin työllisyysvaikutukset – Panos- tuotosanalyysi maakunnittain. 87 s., 17 liitettä.
- No 57 Mustakangas, E., Kiviniemi, M. & Vihinen, H. 2004. Kunta maaseudun kehittämisessä – maaseutu kunnan kehittämisessä. 202 s., 2 liitettä.
- No 60 Uusitalo, P. & Eriksson, C. 2004. Viljanviljelyn perusmuokkausmenetelmien taloudellisuusvertailu. 48 s., 3 liitettä.
- No 73 Rikkonen, P. 2005. Utilisation of alternative scenario approaches in defining the policy agenda for future agriculture in Finland. 223 p., 8 appendices.

