รายงานวิจัยฉบับสมบูรณ์

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“Multifunctional Agriculture: Implications for Policies Toward Sustainable Agriculture and Green Growth in Thailand”

โดย

ชพิกา สังขพิทักษ์

30 มิถุนายน 2559

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Chapika Sangkapitux

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Abstract

For several decades, the agricultural sector has been the backbone of economic development in Thailand, going along with a continuous intensification of land use. As a consequence, environmental deterioration and overexploitation of natural resources can also be widely observed. Multifunctional agriculture is a new and more holistic approach to agriculture, which has the potential not only to mitigate the negative impacts of agricultural intensification, but also provides various public goods and services to society. Examples are food safety and security, natural resource and biodiversity conservation, agricultural landscape values and rural amenities, and flood prevention. For a number of years, agri-environmental policy measures have been widely implemented to promote multifunctional agriculture in many OECD countries. These include a number of regulatory measures under the command-and-control approach, but also increasingly economic incentive policy instruments ranging from direct incentive payments, price-based measures, such as reverse auctions and tender approaches, and market-based measures, such as tradable permits, and cross-compliance measures. In practice, a combination of command-and-control and economic incentive approaches are applied at farm and community levels.

The major objective of this research is to develop a comprehensive knowledge base of international experiences from selected OECD countries in agri-environmental policy implementation. The experience can be used to promote multifunctional agriculture and derive important lessons learned for the particular situation in Thailand. The study is based on an intensive review of the literature on agri-environmental policies at farm level across various OECD countries from different continents including Germany and the United Kingdom, USA and Canada, Australia and New Zealand, Japan and Korea. The review of agri-environmental policy assessments reveals that direct financial payment is the main factor contributing a successful implementation of the agri-environmental incentive-based policy. It also found that environmental concerns and awareness of farmers and farming communities positively enhanced program participation. Farmers' decision to participate in the direct incentive program were influenced by appropriate determination of payment support taking into account the time dimension and opportunity cost of program participation, and the compatibility of promoted agri-conservation practices with existing farming systems and practices. An additional prerequisite for successful policy implementation is complementary support from government and non-governmental organizations in the form of institutional, technical and knowledge assistance.

Lessons learned from the international experience in selected OECD countries, three major policy measures are proposed to promote multifunctional agriculture at the farm level in Thailand. These are 1) direct payments at the farm level for organic farming, 2) direct payments at the farm level for environmentally friendly best management practices, and 3) financial support for community-based programs in promoting multifunctional agriculture, such as organic farming, eco-friendly best management practices, and agro-tourism. Additional complementary measures are provision of technical assistance, marketing, research and knowledge support. Given the holistic approach of multifunction agriculture, a close cooperation among all stakeholders, including individual farmers, farming communities/groups, government and non-government organizations, private and public sectors is also crucial for a successful implementation of the agri-environmental policy measures to promote multifunctional agriculture in Thailand.

บทคัดย่อ

ภาคการเกษตรนับได้ว่ามีบทบาทสำคัญต่อการพัฒนาเศรษฐกิจของประเทศในหลายทศวรรษที่ผ่านมา โดยการพึ่งพารูปแบบการผลิตทางการเกษตรแบบเข้มข้นในการใช้ที่ดินร่วมกับปัจจัยการผลิตอื่นๆรวมทั้งสารเคมีการเกษตร ทั้งในรูปของปุ๋ย ยากำจัดวัชพืชและศัตรูพืช ซึ่งส่งผลต่อผลิตภาพการผลิตที่เพิ่มสูงขึ้น อย่างไรก็ตามรูปแบบการผลิตทางการเกษตรดังกล่าวได้ส่งผลกระทบโดยตรงต่อทรัพยากรธรรมชาติและสิ่งแวดล้อม ความเสื่อมโทรมของทรัพยากรธรรมชาติที่สำคัญ คือ ทรัพยากรดิน น้ำ และความหลากหลายทางชีวภาพ ตลอดจนผลกระทบต่อสุขภาพของเกษตรกรจากการใช้สารเคมีการเกษตรแบบเข้มข้น และต่อผู้บริโภค อันเนื่องมาจากการปนเปื้อนและสารตกค้างในผลผลิตทางการเกษตร การเกษตรเชิงพหุภารกิจ (Multifunctional Agriculture) เป็นรูปแบบการผลิตทางการเกษตรที่เป็นแบบองค์รวมมุ่งเน้นการผลิตสินค้าและบริการที่ส่งผลเชิงบวกต่อสิ่งแวดล้อมและสังคมโดยรวมอาทิเช่น ความมั่นคงและความปลอดภัยในอาหาร การอนุรักษ์ทรัพยากรธรรมชาติและความหลากหลายทางชีวภาพ การเพิ่มคุณค่าของเกษตรภูมิทัศน์ การป้องกันน้ำท่วม และส่งเสริมการพัฒนาชีวิตความเป็นอยู่ของชุมชนในชนบท นโยบายการเกษตรเชิงอนุรักษ์ (Agri-environmental policy) ได้ถูกนำมาใช้อย่างแพร่หลายในกลุ่มประเทศ OECD เพื่อส่งเสริมการเกษตรเชิงพหุภารกิจ โดยมาตรการภายใต้นโยบายการเกษตรเชิงอนุรักษ์ที่สำคัญประกอบด้วย มาตรการการกำกับดูแลโดยใช้กฎระเบียบต่างๆ และมาตรการทางเศรษฐศาสตร์ที่เน้นการให้แรงจูงใจเพื่อทำการเกษตรเชิงอนุรักษ์ อาทิเช่น มาตรการการให้เงินสนับสนุนโดยตรงแก่เกษตรกร มาตรการการดำเนินการผ่านระบบตลาดและราคา รวมทั้งการใช้มาตรการควบคู่กันไประหว่างกฎเกณฑ์เพื่อเป็นเงื่อนไขในการได้รับการสนับสนุนทางการเงิน ที่เรียกว่า cross-compliance งานวิจัยนี้รวบรวมประสบการณ์การนำมาตรการการเกษตรเชิงอนุรักษ์ของประเทศ 8 ประเทศ ในกลุ่ม OECD จาก 4 ทวีป ได้แก่ ประเทศเยอรมันและประเทศสหราชอาณาจักรจากทวีปยุโรป ประเทศสหรัฐอเมริกาและประเทศแคนาดาจากทวีปอเมริกาเหนือ ประเทศออสเตรเลียและประเทศนิวซีแลนด์จากทวีปโอเชียนเนีย ประเทศญี่ปุ่นและประเทศสาธรณรัฐเกาหลีจากทวีปเอเชีย โดยแต่ละประเทศได้มีการนำมาตรการการเกษตรเชิงอนุรักษ์มาใช้อย่างกว้างขวางเพื่อส่งเสริมการเกษตรเชิงพหุภารกิจทั้งในระดับฟาร์มและระดับชุมชน

จากการทบทวนเอกสารการประเมินมาตรการการให้แรงจูงใจทางการเงินเพื่อการเกษตรเชิงอนุรักษ์ที่ใช้ในประเทศ 8 ประเทศในกลุ่ม OECD พบว่า การสนับสนุนทางการเงินโดยตรงเป็นปัจจัยสำคัญที่ส่งผลต่อความสำเร็จในการดำเนินนโยบายส่งเสริมการเกษตรเชิงอนุรักษ์ การให้การสนับสนุนทางการเงินโดยคำนึงถึงมิติด้านเวลาและต้นทุนค่าเสียโอกาสในการปรับเปลี่ยนไปสู่การเกษตรที่เป็นมิตรต่อสิ่งแวดล้อม รูปแบบกิจกรรมอนุรักษ์ที่เหมาะสมกับระบบการทำกิจกรรมการเกษตรที่ดำเนินการอยู่ ทั้งหมดนี้เป็นประเด็นที่เอื้อให้เกษตรกรและชุมชนเข้ามามีส่วนร่วมในการทำการเกษตรเชิงอนุรักษ์ นอกจากนี้ยังพบว่า ความตระหนักเกี่ยวกับสิ่งแวดล้อมของเกษตรกรและชุมชนมีอิทธิพลต่อการปรับเปลี่ยนรูปแบบการผลิตไปสู่การเกษตรที่เป็นมิตรต่อสิ่งแวดล้อม การให้การสนับสนุนและความช่วยเหลือจากภาครัฐและองค์กรเอกชนในการจัดตั้งสถาบัน ให้การสนับสนุนด้านเทคนิคและการให้ความรู้เกี่ยวกับการเกษตรเชิงอนุรักษ์ เป็นมาตรการเสริมที่มีความจำเป็นและมีความสำคัญที่จะส่งผลต่อความสำเร็จในการดำเนินนโยบายส่งเสริมการเกษตรเชิงพหุภารกิจจากประสบการณ์การดำเนินมาตรการการสร้างแรงจูงใจทางการเงินเพื่อการเกษตรเชิงอนุรักษ์ของกลุ่มประเทศ OECD ที่เลือกมาศึกษาในโครงการวิจัยนี้ มาตรการการให้การสนับสนุนทางการเงินเพื่อส่งเสริมการเกษตรเชิงอนุรักษ์ ที่น่าจะนำมาใช้ในประเทศไทย ประกอบด้วย 3 มาตรการหลัก คือ 1) มาตรการให้การสนับสนุนทางการเงิน เพื่อจูงใจให้เกษตรกรปรับเปลี่ยนจากการผลิตโดยใช้สารเคมีมาเป็นการทำการเกษตรอินทรีย์ 2) มาตรการให้การสนับสนุนด้านการเงินเพื่อจูงใจให้เกษตรกรหันมาทำการเกษตรเชิงอนุรักษ์ เพื่อลดปัญหามลภาวะต่อสิ่งแวดล้อมในดิน น้ำทั้งในและนอกพื้นที่การเกษตร และ 3) มาตรการให้การสนับสนุนทางการเงินแก่ชุมชนเพื่อการเกษตรที่เป็นมิตรต่อสิ่งแวดล้อมระดับชุมชน โดยชุมชนดำเนินการเสนอโครงการที่เกี่ยวกับข้องกับการเกษตรเชิงอนุรักษ์ เพื่อขอรับ

เงินทุนสนับสนุน เช่น โครงการเกษตรอินทรีย์ โครงการเกษตรเชิงอนุรักษ์ และการท่องเที่ยวเชิงเกษตร โดยมีมาตรการเสริมในการให้ความช่วยเหลือแก่เกษตรกรทางด้านเทคนิค การตลาด การวิจัยและความรู้ที่เกี่ยวกับการทำการเกษตรอินทรีย์และเกษตรเชิงอนุรักษ์และชุมชน นอกจากนี้การส่งเสริมเสริมให้เกิดความเข้าใจและความร่วมมืออย่างใกล้ชิดระหว่างผู้มีส่วนเกี่ยวข้องทั้งเกษตรกร ชุมชน ภาครัฐและองค์กรเอกชน ภาคเอกชนและภาคประชาชน เป็นปัจจัยสำคัญต่อความสำเร็จในการดำเนินนโยบายการเกษตรเชิงอนุรักษ์ เพื่อส่งเสริมการเกษตรเชิงพหุภารกิจในประเทศไทย

Executive Summary

The economic development path in Thailand has been based on the agricultural sector for more than three decades. Yet, despite agriculture's contribution to economic growth, natural resources and the environment more generally have been degraded and overexploited. In many OECD countries, multifunctional agriculture is increasingly regarded as a viable strategy to mitigate the negative impacts of agricultural intensification. Going beyond the production of tradable private goods, multifunctional agriculture provides a range of positive public goods and services to society in various forms including food safety and security, natural resource and biodiversity conservation, agricultural landscape values, rural amenities, and flood prevention. The major objective of this study is to develop a comprehensive knowledge base of international experiences from selected OECD countries in agri-environmental policy implementation. The experience can be used to promote multifunctional agriculture and derive important lessons learned for the particular situation in Thailand. The study is based on an intensive review of the literature on agri-environmental policies at farm level across various OECD countries from different continents including Germany and the United Kingdom, USA and Canada, Australia and New Zealand, Japan and Korea. Pertinent literature includes case studies published in books, journal articles and research reports, but also policy documents and national statistics.

There are a number of agri-environmental policy measures that can support the provision of positive non-commodity outputs and discourage negative externalities from agriculture at farm level. These include economic incentive and command-and-control regulation measures addressed to individual farmers, community-based policies, and complementary measures which include institutional and persuasive instruments. The rationale for economic incentive measures is that various types of incentives will encourage farmers to produce positive non-commodity outputs, while disincentives are imposed on the production of negative ones. The economic incentive/disincentive measures range from various forms of direct payments to farmers which provide incentives to taxes and charges which act as disincentives. Among the price-based measures there are marketable or tradable permits and tenders or reverse auctions. Such measures provide incentives to achieve environmental targets in a cost-effective way. By contrast, compulsory compliance is required under regulatory and cross-compliance measures. Other incentive-based measures at the community or group-based level come in the form of monetary and non-monetary support mechanisms that encourage collective action among farmer groups and/or farming communities to promote multifunctional agriculture.

A wide spectrum of agri-environmental policy measures has been implemented in the eight selected OECD countries. Instruments to address agriculture multifunctionality vary strongly across the countries. Direct incentive payments at fam level have been employed to support organic farming, agri-conservation practices, and agricultural landscape and biodiversity conservation in all selected countries. A number of community-based measures with the purpose of promoting agri-environmental conservation practices have also been implemented across the selected OECD countries. Price-based and market-based measures to address environmental quality improvement are widely implemented in Australia, New Zealand, and USA. Under the reformed Common Agricultural Policy (CAP), most agri-environmental policy measures implemented in

Germany and the UK can be classified as “cross-compliance measures’ under the EU funding requirement. Success factors and barriers to policy implementation are derived from a review of agri-environmental policy assessments. A major factor contributing to the success of the agri-environmental policy implementation is the provision of financial support through a range of economic incentive measures including direct payment, market-based, price-based, and community-based measures. In addition, compatibility of promoted agri-conservation practices with existing farming systems and practices influences farmers’ decision to participate in the direct incentive program. With regard to farmers’ characteristics, farmers’ environmental concerns and awareness has a positive effect on their participation in agri-environmental incentive-based programs. On the other hand, large farm size, high fertility of farmland, strong financial performance, and farm income as the major form of income discourage policy participation. Social capital referring to shared environmental concerns/values, common understanding and willingness in pursuing agri-environmental conservation, strong leadership and cohesion among community members significantly contribute to successful implementation of community-based programs in a bottom-up approach to identifying agri-environmental issues to be addressed. Complementary support services not only from local government in providing information, technical assistance and regular visits, but also from non-governmental organizations in facilitating the program are necessary elements contributing to the successful implementation of incentive-based policy measures at farm and community levels. Among the major barriers for implementation of farm-based and community-based direct incentive policy measures are (1) failure to take into account the time dimension of agri-conservation conservation practices, such as long-term processes of conversion from conventional agriculture and maintaining organic farming, (2) establishing long-term conservation measures, (3) shifting in government funding policy, and (4) increasing compliance costs due to rigid requirements of funding support.

Among the market-based and price-based measures, flexibility and financial incentives are factors that enhance successful program implementation measures towards achieving cost-effective improvement of environmental quality. On the other hand, major barriers are (1) system complications due to imposed trading rules and restrictions, (2) difficulties in monitoring, particularly in the case of pollution loading from agricultural non-point sources, and (3) negative impacts on farmland value and social capital among the farming communities. Conservation tender is the price-based measure that provides least cost of long-term conservation on farmland. Landholders’ altruistic attitudes and concerns about the environment together with strong and trustful relationship between landholders and implementing agencies are crucial factors for the success of this measure. A long-term duration of contract under the conservation tender scheme potentially discourages farmers’ participation due to uncertainty regarding future farmland value.

From the review of experiences in agri-environmental policy measures in the selected OECD countries, three policy measures are regarded as having a particularly strong potential for promoting the concept of multifunctional agriculture in Thailand. These are 1) direct payments for organic farming at the farm level, 2) direct payments for eco-friendly best management practices at the farm level, and 3) financial support for community-based programs in promoting multifunctional agriculture, such as organic agriculture, environmentally friendly best management practices, and agro-tourism.

Financial payments for conversion to organic agriculture are justified because farmers have to bear various costs incurred. These costs result from changes in their production system, but also from benefits forgone particularly during the transitional period from conversion to organic farming. The three major aspects of incentive measures to promote organic farming which need to be considered are types of payment, duration, and complementary supports. When taking into account the costs incurred to farmers from conversion to organic agriculture, area-based payments need to be offered not only during the conversion period, but also for maintaining the farmland under organic agriculture on a permanent basis. Conversion from conventional to organic agriculture requires a certain time span for transition. Hence, to ensure the successful implementation of direct payments for organic farming, a long-term commitment for provision of payment support will certainly enhance farmers' participation and ensure continuation of organic farming. In order to be certified as 'organic farming", various rules and regulations need to be followed. Hence, technical support along the transition process from conventional chemical-based agricultural practice to organic farming is a crucial element provided to farmers for successful uptake of organic farming. Regular monitoring visits by local government officers are required to ensure compliance with the direct payment support program. In addition, provision of marketing support, organic certification advisory and raising public awareness on the positive contribution of organic agriculture to an improved environment, to better food safety, and to mitigating climate change would contribute to the long-term development of organic farming in the country.

To target environmentally sensitive areas in Thailand, such as erosion-prone hillsides, wetlands, biodiversity-rich areas and watersheds, direct financial payments can be applied to incentivize farmers to adopt environmentally friendly best management practices. Determination of payments requires careful consideration of both benefits accrued to society and costs incurred on farmers including implementation and maintenance of the conservation measures and long-term opportunity costs of land under conservation. Long-term commitment for financial support to farmers is crucial for sustaining provision of agri-environmental public goods and services derived from best management and conservation practices. Complementary supports in the form of provision of technical assistance, information and knowledge related to agri-conservation practices, together with the establishment of close networks linking farmers and local government officers responsible for program implementation are elements that enhance program uptake.

Group-based or community-based incentive payments can be applied to promote multifunctional agriculture and agro-tourism at community level which not only provide agri-environmental pubic goods and services to the wider society, but also contribute to rural development at the community level. Apart from financial support, scientific knowledge and expert advice provided by government agencies are essential for identification of agri-environmental issues to be addressed within the community. In addition, accommodating non-government organizations that can provide complementary support, such as organic certification services, could help facilitate the program implementation at community level.

Various institutional arrangements could be created to accommodate direct incentive payment measure in promoting multifunctional agriculture in Thailand. A new department with its regional and local offices under the Ministry of Agriculture and Cooperatives focusing on multidisciplinary and holistic approaches to multifunctional agriculture could be established to take responsibility in agri-environmental incentive-based policy formulation and implementation. Involvement of all stakeholders including government and non-government organizations, private and public sectors, farmer groups and community representatives can be institutionalized in the form of a committee providing advice to the newly established department. Building a platform for provision of information to and feedback from the public is another essential element for enhancing public understanding and awareness in agri-environmental conservation.

The introduction of the incentive-based payment measures proposed in this study to promote multifunctional agriculture depend strongly on the availability of sufficient financial resources. A long-term budgeting commitment is essential to ensure the continuation of agri-environmental conservation practices. As a consequence, sustainability of multifunctional agriculture can be achieved. To justify the allocation of financial resources under budget constraints, it can be argued that the provision of ecosystem services through multifunctional agriculture (1) generates wider societal benefits, such as food safety and landscape diversity (2) produces various public goods, such as landscape beauty and reduced GHG emissions and (3) contributes to several sustainable development goals (SDGs), such as life on land, good health and well-being and clean water and sanitation. These are considered good reasons for justifying the allocation of the budget to support the agri-environmental incentive-based policy measures. Additional sources of budget could be sought from international funding agencies. To tap into international funds, it should be emphasized that multifunctional agriculture has benefits not only at the national, but also global level, considering healthier ecosystems, wildlife habitats, reduced GHG emissions, and positive contributions to the SDGs.

List of Abbreviations

ACT	Organic Agriculture Certification Thailand
AEGP	Agri-environmental Group Planning
AGGP	Agricultural Greenhouse Gases Program
ALUS	Alternative Land Use Services
ATPULM	Appropriate Treatment and Promotion of Utilisation of Livestock Manure
AWSA	Assiniboine Watershed Stewardship Association
BMPs	Beneficial Management Practices, Canada
BMPs	Best Management Practices
BPS	Basic Payment Scheme
CAP	Common Agricultural Policy
CRP	Conservation Reserve Program
CSF	Catchment Sensitive Farming
CSP	Conservation Stewardship Program
DEFRA	Department for Environment Food & Rural Affairs, UK
DELWP	Department of Environment, Land, Water and Planning
DPEFF	The Direct Payments for Environmentally Friendly Farming
DPFHMA	Direct Payment to Farmers in Hilly and Mountainous Areas
DWPA	Diffuse Water Pollution from Agriculture
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agricultural Guarantee Fund
EFAs	Ecological Focus Areas
EFDPP	Environmentally Friendly Direct Payment Program
EFP	Environmental Farm Plan
EPA	Environmental Protection Authority
EQIP	The Environmental Quality Incentives Program
ERCs	Emission Reduction Credits
ETS	Emissions Trading Scheme
EU	European Union
FAO	Food and Agriculture Organization
FAS	Farm Advice Service
FPT	Federal, Provincial/Territorial
GAECs	Good Agricultural and Environmental Conditions
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GOs	Government Organizations
IROWC-P	Indicator of Risk of Water Contamination by Phosphorous
KULAP	Bayerisches Kulturlandschaftsprogramm
LCAs	Landcare Associations

MAFF	Ministry of Agriculture, Forestry and Fisheries, Japan
MAFF	Ministry of Agriculture, Forestry and Fisheries, Japan
MCILWE	Measures to Conserve and Improve Land, Water and Environment
MCILWE	Measures to Conserve and Improve Land, Water, and the Environment
MEKA	Marktentlastungs-und Kulturlandschaftsausgleich
MIC	Ministry of Internal Affairs and Communications, Japan
MOAE	Ministry of Agriculture and Cooperatives, Thailand
MOE	Ministry of Environment, Japan
MWU	Man Work Unit
NGOs	Non-government Organizations
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NZAGRC	New Zealand Agricultural Greenhouse Gas Research Centre
OECD	Organisation for Economic Co-operation and Development
PANCTP	Pennsylvania Nutrient Credit Trading Program
PGGRC	Pastoral Greenhouse Gas Research Consortium
RMC	Resource Management Act
SAGES	Sustainable Agriculture Environmental Systems
SDA	Sustainable Development of Agriculture
SDGs	Sustainable Development Goals
SFF	Sustainable Farming Fund
SMRs	Statutory Management Requirements
STAC	Scientific and Technical Advisory Committee
UK	United Kingdom
USA	United States of America
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency

Chapter 1
Introduction

1.1 Rationale of the research

Agriculture has been the strongest basis of the economic development path in Thailand for more than three decades. Yet, along with such successful economic development, a continuous deterioration of natural resources and environment can also be widely observed. Contamination with chemicals that are excessively used in the agricultural sector to increase productivity is detected not only in agricultural commodities and in humans, but also in our water and soil resources (Tirado et al., 2008). Multifunctional forms of agriculture have been discussed widely as a strategy to mitigate the negative impacts of agricultural intensification. The concept of multifunctionality acknowledges that the farming sector – if managed in a sustainable way – can provide a range of positive contributions to society and the environment. Multifunctional agriculture can thus not only produce tradable private goods like grain and meat, but also public goods, such as agro-biodiversity conservation, landscape values, rural amenities, flood prevention and food security (Renting et al., 2009; Van Huylenbroeck et al. 2007; OECD 2001). However, in order to foster multifunctional farming systems, a viable policy framework needs to be developed taking into account of maintaining and enhancing food production, while supporting both an improvement of positive functions and an eradication of negative externalities, thereby sustaining the rural livelihoods and economies (Groenfeldt 2009; OECD 2003; Pretty et al., 2001).

Agri-environmental policy measures pursuing a multifunctional agriculture approach have been implemented in various developed countries, such as USA, Canada, Japan, Korea, Australia, New Zealand, and EU countries, since the early 2000s (OECD 2009 and 2008). In this research report, these policies measures are outlined for their strengths and weaknesses in order to assess their applicability to the Thailand context. It is hypothesized that the diverse policy experiences in the countries under study will provide important lessons for developing an innovative institutional framework for advancing multifunctionality in the Thai agricultural sector. Drawing on the experiences of various countries, this research aims at examining how multifunctional agricultural policy measures can be developed in Thailand in order to support sustainable agricultural production systems and promote green growth. The main focus is on identifying a policy mix of economic incentives at farm and community levels. As multifunctional agriculture is considered as a holistic approach, an appropriate combination of innovative policy measures is needed that simultaneously achieve sustainable agriculture, preserve a range of rural amenities and ecosystem services, and contribute to the improvement of rural livelihoods and to a greening of the rural economy.

It is important to acknowledge that farmers are not only motivated by economic incentives, but that cultural norms, social recognition, and intrinsic motivation are also important factors that determine their response to policy instruments. It is also crucial to involve farmers and other rural stakeholders in the process of developing and implementing policy instruments for stimulating the social and economic changes that are needed to implement multifunctional agriculture. Organic farming and agro-tourism can be essential components of

multifunctionality, as such practices can reduce environmental pressures and foster the provision of ecosystem services. At the other side of the value chain, the consumers can also contribute to the concept of multifunctionality by reducing food waste and meat consumption and by stating their preferences for agricultural commodities that are grown under sound agro-ecological conditions. This could be achieved through various economic instruments like food taxes/subsidies and through changing dietary habits and norms. Finally, Thai society needs to come to an understanding that the purpose of agriculture in the context of multifunctionality is not just to produce food, but also to provide essential public goods and services. It cannot be expected that such goods and services are always provided for free, but require citizens to pay for their provision.

The major objective of this study is to generate a comprehensive knowledge base of international experiences with implementing multifunctional agricultural concepts and derive important lessons learned for the particular situation in Thailand. It is expected that this research will make an important policy contribution towards sustainable agriculture and green growth across diverse rural areas in Thailand.

1.2 Research objectives

The objectives of this research are as follows:

1) to provide a conceptual framework and a theoretical background of “Multifunctional agriculture”

2) to review agri-environmental policy measures implemented in selected OECD countries and outline strengths and barriers of the policy measures

3) to propose a comprehensive policy mix for promoting “Multifunctionality of Agriculture” at farm level to support a sustainable agricultural production and green rural growth in Thailand

4) to propose an institutional context in supporting “Multifunctionality of Agriculture” in Thailand

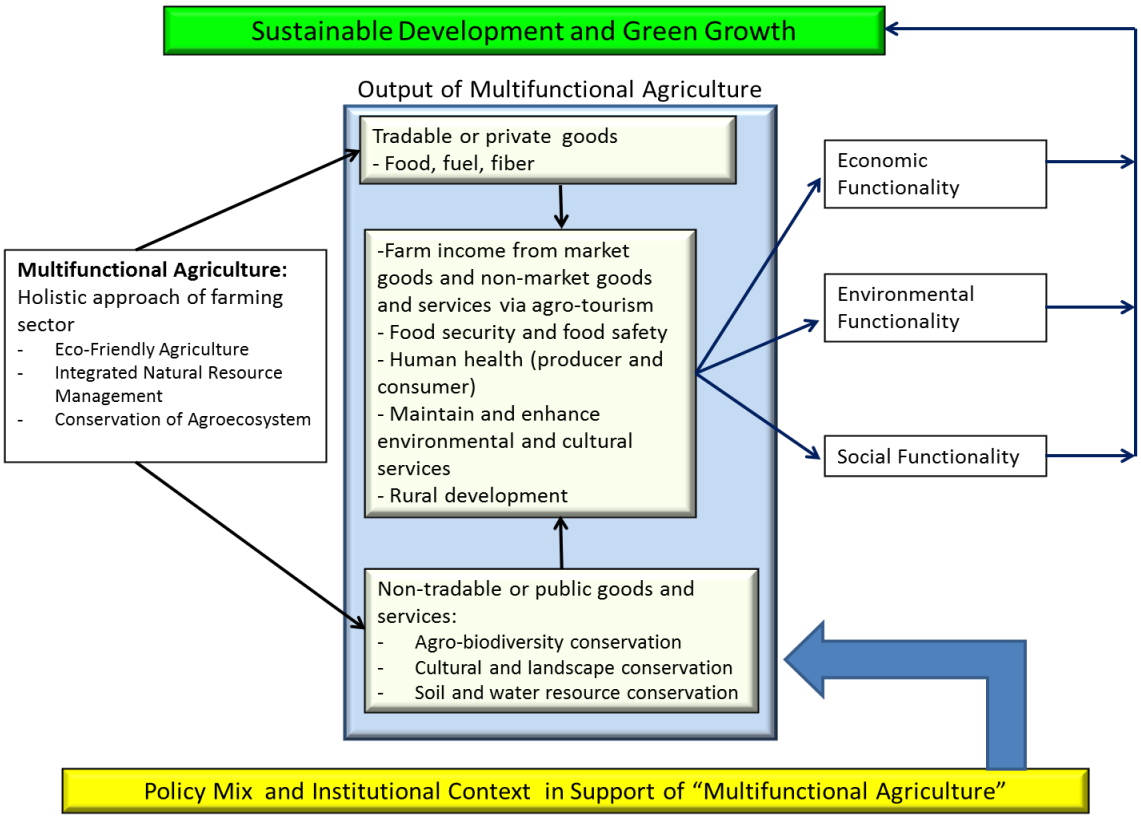
1.3 Research methodology

This research is based on an intensive literature review agri-environmental policies at farm level across various OECD countries from different continents including USA and Canada, Japan and Korea, Australia and New Zealand, Germany and the United Kingdom on the basis of policy documents, national statistics and published case studies. These eights countries provide a wide range of coverage in main continents including Asia, Australia, North America, and Europe. The reason of selecting Germany and the United Kingdom as representatives of EU member states are that agri-environmental policy measures have been implemented widely in these two countries, and accessibility of academic documents and reports from governments and international and national organizations in English is also important for this research. Strengths and barriers in agri-environmental policy measures implemented in these selected OECD countries are derived from a review of the assessment of some agri-environmental policy measures based on available academic papers. Additionally, experts’ opinions on agri-environmental policy measures to be applied in Thailand can be assessed through e-mailing and interviewing via skype.

1.4 Research framework

Multifunctional agriculture is a holistic approach of the farming sector that includes eco-friendly forms of agriculture (e.g. organic farming), integrated natural resource management and conservation of agroecosystems. The underlying concept is that the agricultural sector has multiple roles, not just to produce food, fuel and fiber, but also to provide several non-market commodities that often have the characteristics of public goods and services (e.g. cultural and landscape conservation). Farm income in this concept is derived from both market and non-market goods and their economic, environmental and social functionalities contribute to sustainable development and green growth. In order to support multifunctional agriculture and its beneficial outputs for farmers, the environment and the society as a whole, a well-designed policy mix under an appropriate institutional context is essential for successful policy implementation leading toward sustainable development and green growth. The research framework is depicted in Figure 1.1.

Figure 1.1 Research Framework



1.5 Structure of the research report

This research report is organized in eight chapters. Following the introductory chapter, Chapter 2 provides concept and theoretical framework of Multifunctional agriculture. Policy measures supporting multifunctional agriculture at farm level is discussed in chapter 3. Experiences in multifunctional agriculture policy implementation of selected OECD countries and assessment for their successes and limitations are reviewed in Chapters 4-7. The lessons learned and implications for agri-environmental policy in promoting multifunctional agriculture in Thailand are discussed in Chapter 8, followed by the conclusion in the final chapter.

Chapter 2

Multifunctional agriculture: concept and theoretical framework

This chapter provides a review of the concept and theoretical framework of "Multifunctional Agriculture". Since 1992, the term "multifunctional agriculture" has emerged as a response to public concerns about the various functions or benefits/costs derived from agricultural activities. Multifunctional Agriculture has been conceptualized in three main approaches; a positivistic and market-economy oriented approach proposed by OECD and the WTO, the human-rights and food-security approach by FAO, and the rural development-oriented approach from the EU (Zander et al., 2005). Yet the concept of multifunctionality in the agricultural sector has been interpreted in different ways. Based on the concept by OECD (2001: 5), multifunctional agriculture is recognizing that "beyond its primary function of supplying food and fiber, agricultural activity can also shape the landscape, provide environmental benefits such as land conservation, the sustainable management of renewable natural resources and the preservation of biodiversity, and contribute to the socio-economic viability of many rural areas". It can be acknowledged that agriculture is not just an economic activity producing commodity outputs, but also offering a range of non-market outputs or public goods. These encompass the contribution of agriculture to fostering viable rural areas, to sustaining the local cultural heritage, to providing opportunities for agro-tourism, and to securing a number of ecological services, such as soil protection, flood control, landscape diversity, and agro-biodiversity conservation. Some of these ecological services may have a direct use value both for farmers and for society as a whole, while others may be of non-use value (e.g. existence and bequest values). Taken together, the multiple services that agriculture provides in terms of food security and safety, socio-economic development of rural areas, and ecosystem and watershed functions are enshrined in the concept of "multifunctional agriculture" (see van Huylenbroeck et al. (2007) for a comprehensive review of definitions). From the concept defined by OECD (2001), multifunctional agriculture can be defined based on two approaches, normative and positive approaches. Based on the normative approach, agricultural activities provide valuable multiple functions to society namely production, environmental and socio-economic functions, while the positive approach focusses on the characteristics of multiple outputs including public and private goods, commodities and non-commodities, obtained from a jointness in agricultural production. The concepts of externalities, rights, and transaction costs are important for providing the theoretical basis for multifunctional policy implication (Groenfeldt, 2009; Van Huylenbroeck et al. 2007; Vermersch, 2001).

2.1 Multiple functions of agriculture

From the normative or demand side point of view, the main focus is on multiple functions offered by agriculture to society. Production, environmental, socio-economic functions all need to be clearly identified in order to provide the society a basis to assign value attached to these multiple functions (Van Huylenbroeck et al., 2007).

2.1.1 Production function

The primary function of agriculture is to produce food, feed and fiber. Conventionally, the provision of food production measured in physical and economic terms is considered the most important component of agricultural services to society. Food related aspects (food security and food safety) have gained considerable

attention as functions provided by agricultural activities. Among the four dimensions of food security namely (1) availability, (2) access, (3) utilization and (4) stability derived from the definition by the World Food Submit (1996), the main contribution of agriculture is to meet the food security at local, domestic, and global levels by providing sufficient food supply at all times. Agricultural intensification through the technological innovations under the green revolution, i.e. using high yield varieties, agrochemicals, and genetically modified technology, have played an important role in contributing to national and global food security by increasing food supplies and reducing food prices via the domestic and international market mechanism. However, the issue of food insecurity is still being witnessed across all levels (local, national, regional and global) showing that intensive agriculture might not be able to ensure food security for all societal groups and, in addition, has posed negative external effects to the environment and also to human beings. Examples of these negative external effects are pollution of waterways and groundwater with agrochemical residues, threats to biodiversity, clearing of forestland and harmful impacts on human health. In the context of agricultural multifunctionality, it is argued that less intensive forms of agriculture with higher diversity and viability of crop production systems could contribute to local and domestic food security, while at the same time generating environmental, social and cultural benefits (Groenfeldt, 2009; Grega, 2004; OECD, 2001). The close links between health and wellbeing of both consumers and producers with food quality and safety issues are a growing concern for civil society groups and governments alike. In addition, the negative health effects derived from chemical residues in conventional food production and practicing chemical based production have been observed. Switching from a chemical-based agricultural system to organic farming and other eco-friendly farming systems as the basis of multifunctional agriculture offers not only safer products to consumers, but also mitigates negative health impacts on farmers.

2.1.2 Environmental function

It is generally known that agriculture and the environment are closely interrelated. Agricultural activities affect the environment in both positive and negative ways and the environment conversely poses effects on the agriculture, hence there is a bidirectional relationship and feedback mechanism between the two. The impacts of agriculture on the environment depend very much on types of farming systems. Conventional, intensive chemical-based farming often leads to soil degradation and erosion, water pollution, and also biodiversity reduction. Consequently, such agricultural systems cannot not be sustained in the long run, while agro-biodiversity, soil and water resource conservation can generally be enhanced by more extensive agricultural practices (Groenfeldt, 2009; Grega, 2004). It is also widely known that agriculture is one of the major contributors to greenhouse gas (GHG) emissions, particularly intensive paddy rice farming and cattle rearing through their high methane (CH_4) emissions and land conversion from forests and peatlands which emit high amounts of CO_2. Compared to conventional agriculture, organic farming systems support carbon sequestration and reduce GHG (Kotschi and Müller-Sämann, 2004). Positive environmental impacts in the form of agri-ecological production and environmental conservation offered by sustainable agriculture practices (e.g. organic farming) certainly benefit the whole society (Van Huylenboreck et al. 2005). However, the benefits come at a cost, for example in terms of higher amount of land needed for the same level of output and increased labor costs. These costs need to be covered by farmers, consumers and society at large.

2.1.3 Socio-economic function

Agricultural landscape formation, cultural heritage conservation, and rural development are considered socio-economic benefit derived from multifunctional agriculture. 'Agricultural landscape' is broadly defined as the visual effect covering both natural and human-made elements providing amenity value to society. The natural element refers to the physical effect of agriculture including vegetation and animal husbandry. Terracing, contour planting, building stone walls or live fences for demarcation, and irrigation ditches are examples of human-made elements that account for the value of farming landscape (Groenfeldt, 2009). However, some forms of human management activities could negatively affect the agricultural landscape value. For instance, converting rice terraces to high-value vegetable plantation under greenhouses might increase farmers' economic return, but could negatively affect the agricultural landscape value. Cultural heritage of agriculture refers to intangible elements (such as traditions, skills, ceremonies) and tangible elements (such as farm dwellings, stables, barns, storage facilities) related to agriculture (ICOMOS, 2010). Finally, multifunctional agriculture enhances rural development by offering a diversification of livelihood opportunities into on-farm and off-farm employment. High demand for on-farm labor can be expected under extensive, organic farming systems to produce safe and high-quality commodities, while off-fam job opportunities to support agro-tourism can also be created (Groenfeldt, 2009).

2.2 Characteristics of multifunctional agriculture outputs

While the normative approach emphasizes society's enhanced value from multifunctional agriculture, the positive or supply approach looks at the production process and the characteristics of multiple outputs (Van Huylenbroeck et al., 2007). As defined by OECD (2001) mentioned above, multifunctional agriculture provides two main types of outputs; commodity and non-commodity outputs. Food, fiber and other marketable products are classified as commodity outputs, while non-commodity outputs refer to food security and safety, ecological services, rural landscape and agricultural traditions obtained under the multifunctional farming systems (Duran and Van Huylenbroeck, 2003). From an economic point of view, the outputs of multifunctional agriculture are characterized as public and private goods, under jointness in production. These theoretical aspects will be discussed in detail below. In addition, issues of externality, rights, and transaction cost will also be provided as an important basis for policy implication of multifunctional agriculture.

2.2.1 Public and private goods

Based on Ostrom et al. (1994), excludability and rivalry in consumption are the main dimensions differentiating public and private goods. Private goods are characterized as goods where there is rivalry and excludability in consumption. Public goods, on the other hand, are non-excludable, as it is too costly or even impossible to exclude others from consumption. For example, it is impossible to exclude someone from looking at a scenic landscape or from breathing fresh air in a forest. Public goods are also non-rivalrous, as consumption of one person would not reduce the value of the good for others (Vatn, 2002).

In the context of multifunctional agriculture, commodity output is generally classified under private goods. As for the commodity outputs, efficient allocations can be obtained via market mechanism. This is because when

excludability is possible, a price can be charged reflecting the individual's utility of consuming such goods. Moreover, rivalry in consumption could mitigate the problem of free riders. Hence, the market price would reflect both the consumer's willingness to pay and the producer's marginal cost of production of the commodity outputs. On the other hand, non-commodity outputs of multifunctional farming system are classified as public goods with various degree of non-excludability and non-rivalry in consumption. This contributes to the failure of the market to achieve efficient allocations of non-commodity outputs (Romstad et al., 2000).

2.2.2 Jointness in production

The definition of multifunctional agriculture explicitly refers to a joint production process offering multiple outputs from the use of inputs. The jointness in production occurs under either technical or economic interdependencies. A technical dependency refers to the production of one output which will simultaneously generate one or more other outputs, given a specific set of input use. This is based on biological, chemical, and physical relationships in production process. The joint outputs can be either competing or complementary with each other. An example of a technical interdependency in multifunctional agriculture is that improvement of soil productivity is considered as a non-commodity output obtained from crop rotation. An economic interdependency refers to the presence of non-allocable or allocable fixed or quasi-fixed inputs use for the production which cannot be allocated and managed separately between outputs, and multiple outputs are created. For example, a certain farming land and structure, considered as non-allocable input, provides not only commodity agricultural outputs (or private goods), but also other non-commodity outputs such as landscape which is classified as public goods (Wossink and Swinton, 2007; Van Huylenbroeck et al., 2007; Abler, 2004; Vatn, 2002; Romstad et al., 2000).

2.3 Externality, rights, and transaction cost in multifunctionality of agriculture

Externality can be interpreted differently depending on whether a normative (demand) or a positive (supply) approaches to agricultural multifunctionality is applied. From the perspective of a positive approach, positive and negative externalities are considered as good or bad outputs derived from the jointness of farming productions. By contrast, positive externalities are viewed from the normative side as benefits to the society, and should be encouraged to achieve the level desired by the society. Negative externalities, on the other hand, are costs imposed on society which need to be mitigated. The issue of externality directly links to market failure. A failure of the market to internalize a cost of negative externality results in overproduction of unwanted non-commodity output, such as pollution or destruction of biodiversity. Underproduction of non-commodity output occurs as the market fails to capture the benefits offered from the generation of positive externalities (Van Huylenbroeck et al., 2007; Abler, 2004; Vermersch, 2001).

From an economic point of view, the challenge is to determine those values that are non-marketable in a conventional way, i.e. the positive externalities that are often taken for granted by other economic sectors and by non-farming citizens and whose contributions to overall social welfare may be substantial, while not being adequately reflected in conventional economic assessments. The studies of Birol et al. (2009) and Morey et al. (2008) aimed at eliciting farmers' willingness to engage in multi-functional agriculture practices and rural landscape conservation, while Grammatikopoulou et al. (2012), Arriaza et al. (2008) and Birol et al. (2006)

focused on citizens' preference assessment. The valuation of non-market outputs from both demand and supply sides is essential for designing policy instruments in support of multifunctional agriculture.

Based on Coase theorem (Coase, 1960), the problem of market failure under the presence of externalities, either positive or negative, can be solved if property rights are completely defined and assigned, and if the cost of negotiation, so-called transaction cost, is sufficiently low or zero. For example, water resource contamination and decrease in biodiversity are a typical consequence of a chemical-based farming system. In this case, a land use decision on specific farming is considered as a farmer's individual right on a privately owned farm land, while water resources and agro-biodiversity are public goods. Negative externalities (water resource contamination and decrease in biodiversity) are created as rights to public goods (water resource and biodiversity) are not clearly defined and assigned. In case of clearly defined and assigned property rights, externality cost can be internalized to the land owner, and alternative uses of land (such as conversion from chemical-based practice to organic farming) could be a result. Hence, it is argued that well-defined property rights are crucial for resource distribution, but to achieve the optimal allocation of resources, transaction cost has to be taken into an account. The term 'transaction cost' refers to costs of acquiring information, bargaining, and policy implementation and enforcement. Under the presence of externalities as joint products of agricultural multifunctionality, high transaction cost is expected (Vatn, 2001; Romstat et al., 2000; Dahlman, 1979).

Chapter 3

Agri-environmental policy measures supporting multifunctional agriculture

This chapter provides a review of policy measures supporting provision of positive non-commodity outputs and discourage negative externalities from agricultural multifunctionality. A range of agri-environmental policy measures are discussed in this chapter, including economic incentives and command-and-control regulation measures applied directly to individual farmers, community-based policies, and complementary measures including institutional and persuasive instruments. In practice, a mix of policy measures is required to address various functions derived from multifunctional agriculture systems. Throughout this chapter and the following chapters, the term “agri-environmental” measures will be used referring to policy measures implemented in addressing provision of agri-environmental public goods and services. The objective of this chapter is to discuss each policy measure individually with regard to its application. Finally, this chapter provides a review of criterion for policy assessment. Implementation of the agri-environmental policy measures by various OECD countries will be analyzed based on the assessment criterion in the following chapters.

3.1 Agri-environmental policy measures based on economic incentive approach

Economic incentive measures are based on the idea that incentives, provided in various forms, would encourage farmers to produce positive non-commodity outputs, while disincentives are imposed on the production of negative ones. The economic incentive/disincentive measures range from different types of direct payments to farmers on the incentive side to taxes and charges on the disincentive side.

3.1.1 Incentive payments

Incentive payments are direct payments in monetary terms serving as incentives to farmers to provide positive non-commodity benefits associated with agriculture. Based on Vojtech (2010) and Pretty et al. (2001), types of direct payments are classified as follows;

- Incentive payments based on farming practices: These measures offer farmers monetary incentives to practice multifunctional agriculture farming. Conversion from conventional agriculture to environmentally friendly practices, such as organic farming, low-input extensive farming, integrated farming, and farming with soil and water, biodiversity, and landscape conservation measures are promoted under the direct payment schemes implemented in various OECD countries (Vojtech, 2010).
- Incentive payments based on farm fixed asset: Monetary payments are offered to offset fixed investment costs incurred from changing toward multifunctional agriculture systems. Investment in water saving irrigation system, manure storage facilities, animal waste management systems, and shelterbelt planting are examples of activities supported under these incentive payments. These direct payment schemes focus on long-term capital investment aspect, hence it is very important that a sufficient amount of lump-sum payments is considered to support farmers’ decision to participate in these schemes.

- Incentive payments based on land retirement: Land retirement refers to leaving land free from agriculture activities in order to reserve for environmental purposes such as biodiversity and habitat protection, watershed conservation, wetland restoration, and afforestation. In this case, long-term benefit forgone of retired land needs to be carefully estimated as a basis for payment incentives.

Implementation of the direct payment incentives varies according to the specific physical, social and political conditions in each country. However, with regard to the payment schemes, identification of sufficient amount of payments, basis of payment (e.g. based on inputs, outputs), frequency of payment (e.g. lump-sum payment, annual payment) and duration of payments (e.g. short, medium or long term) are crucial factors contributing to the continuous uptake of multifunctional agriculture systems (Vojtech, 2010; Pretty et al., 2001).

3.1.2 Taxes and charges

Unlike direct payments mentioned in the previous section, taxes and charges are considered disincentives imposed on the provision of negative externalities. Taxes are generally applied on the sale of environmentally unfriendly inputs, such as chemical fertilizer, herbicides, and pesticides. Charges, on the other hand, are imposed on negative non-commodity outputs, such as water and air pollution discharged from farms. In practice, pollution discharged from agriculture is difficult to measure, so imposing charges is applied on the basis of the production of commodity outputs. For example, charges on pollution emissions from livestock farming is based on the number of animals held on the farm (Vojtech, 2010; Pretty et al., 2001).

3.1.3 Tradable permits and reverse auctions

Tradable permits and reverse auctions are market-based and price-based instruments that aim at cost-effective achievement of an environmental target. Tradable permits, market-based measures, are usually set on the basis of a certain maximum loading of pollution and the trade occurs between polluters and those who offset the pollution. Reverse auctions, price-based measures, are won by the bidder who offers the most inexpensive provision of agri-environmental goods and services. These measures are common in Australia, New Zealand, and the United States (Vojtech, 2010).

3.2 Regulatory measures based on command-and-control approach

Unlike economic incentive measures, compulsory compliance is required under regulatory measures. Farmers who fail to comply would face legal penalties such as fines. Regulatory measures can be divided into two groups as follows:

3.2.1 Regulatory requirements

Regulatory requirements are widely applied to address environmental issues derived from agriculture. The main purpose is to regulate farmers' behavior regarding negative externalities produced from farming activities. Various forms of regulatory requirements can be imposed along the farming production process. Bans or restrictions on the use of dangerous chemical fertilizers, herbicides and pesticides, restrictions on environmentally damaging practices, and imposing thresholds on the maximum allowance of pollution

discharged are all examples of regulatory requirements aiming at mitigation of negative externalities, such as pollution, erosion, soil and water resource contamination (Vojtech, 2010; Pretty et al., 2001).

3.2.2 Cross-compliance mechanisms

Cross-compliance mechanisms combine regulatory requirements and direct payment measures to encourage agri-environmental practices. To be eligible for obtaining or participating in direct payment schemes, it is compulsory for famers to fulfil certain environmental requirements. In most cases, the regulatory requirements under the cross-compliance mechanisms are for farmers to adopt certain environmentally friendly practices, not to impose restrictions as mentioned in 3.2.1. For example, minimum obligations on applying eco-friendly inputs or practices are often imposed on farmers as a pre-condition to be fulfilled in order to become eligible to participate in agri-environmental support programs (Vojtech, 2010).

3.3 Community-based measures

Community-based measures refer to measures that do not target individual farmers, but are applied to groups of farmers or farming communities. Under these measures, administrative and/or monetary supports are offered to encourage collective action for the provision of agri-environmental public goods and services such as preservation of agricultural landscape and culture heritage, and biodiversity conservation through cooperation among farmers (OECD, 2013b; Vojtech, 2010). This addresses the challenge of preserving agro-ecological services that cannot be sustained through individual efforts of farmers alone, but need the support from the entire community or from multi-stakeholder networks. These measures are particularly important when working at the landscape or watershed level.

3.4 Complementary measures

Based on Vojtech (2010), complementary or institutional measures are generally provided in the form of non-monetary support which helps enhancing positive non-commodities output and/or discouraging provision of negative externality from agriculture activities. Financial support on research and development on the issue of the relationship between agriculture and environment can be considered as one example of a complementary measure. Knowledge and information generated from studies in the field of multifunctional agriculture would help supporting farmers' transformation process toward eco-friendly practices. Provisions of technical assistance and extension services also support voluntary adoption of multifunctional agriculture systems. Labeling, standards and certification of agricultural products obtained from eco-friendly farming are attributes that have gained increasing attention in policy circles and show rising demand from consumers and society. Being certified and labelled as agri-environmentally friendly products can command price premiums in niche markets. Provision of credible certification and labelling as a complementary measure would induce farmers' willingness to adopt multifunctional agriculture practices, as they could foresee a long-term improvement in farm income (Vojtech, 2010).

3.5 Criteria for policy assessment

According to Hanley (1989), the two major criteria in policy assessment are efficiency and effectiveness. Efficiency can be measured through cost-benefit analysis, while policy effectiveness can be determined by a combination of a number of indicators, including performance-based indicators (e.g. the number of participating farmers), area-based indicators (e.g. the area on which conservation measures required by the policy is implemented) , activity-based indicators (e.g. the number of soil conservation practices on the farmland), and result-based indicators (e.g. the number of threatened species found on farm areas participating in a biodiversity conservation program). Wilson and Buller (2001) define three levels of indicators for in-depth policy assessment. On the first level, policy uptake and outputs are measured by the number of contracts or farms, the area under contract, and the expenditure. On the second level, policy outcomes refer to the actual effect of policy measures on farm management practices, production, income, and certain environmental variables. The third level looks at impacts of policy measures on farmers' attitudes, knowledge creation, social action, and on the wider institutional environment.

In this report, the review of policy assessment is based on available published documents capturing main agri-policy measures implemented by selected OECD countries. As agri-environmental policy measures have been implemented relatively recently, policy assessments of the reviewed papers are mainly based on policy effectiveness and/or uptake and determining factors of policy participation.

Chapter 4

Experiences from Germany and the United Kingdom

This chapter provides review of agri-environmental policy measures implemented in Germany and the United Kingdom. Prior to that, CAP reform, performance of agriculture sector and agri-environmental issues are briefly presented. An assessment of selected policy measures from each country are provided based on literature reviews.

4.1 CAP Reform

The Common Agricultural Policy (CAP) is the main agricultural policy implemented by member states of the European Union (EU). CAP consists of two pillars; Pillar I funded by the European Agricultural Guarantee Fund (EAGF); Pillar II co-funded by the European Agricultural Fund for Rural Development (EAFRD) and EU member states. Under Pillar I, support measures to famers are provided in the form of direct income payments and market management. Supports for sustainable agriculture, environmental management and rural development are provided under Pillar II. CAP has been reformed on a regular basis to adjust to various new challenges. The latest CAP reform of 2013 has aimed at achieving food safety and food security, while sustaining agriculture and resource environmental management in the EU member states, and addressing territorial issues regarding climate change (EC, updated 18/09/2015; Hart, 2015; Nitsch et al., 2014).

Agri-environmental policy measures – which are the main focus in this study – have been supported under Pillar II with the six priority areas of 1) promoting knowledge transfer and innovation; 2) fostering agricultural competitiveness and sustainable forest management; 3) enhancing food chain organisation, including processing and marketing, and risk management; 4) rehabilitating, preserving and enhancing ecosystems; 5) enhancing resource efficiency and fostering the transition to a low-carbon economy; and 6) promoting social inclusion, poverty reduction and economic development in rural areas. Instigated in 2015, greening direct payment offered under Pillar I of CAP is an area-based payment with particular requirements including promoting crop diversity, preserving so-called ecological focus areas (EFAs), and maintaining permanent grassland (EC, updated 18/09/2015; Hart, 2015; Nitsch et al., 2014).

Apart from supports under the two main pillars, one important element of the CAP is cross compliance. The objective of cross compliance is to make European agriculture more sustainable. This is to be achieve through better awareness of CAP beneficiaries about the statutory rules within the EU, thereby making CAP more beneficial for the wider society. Cross compliance refers to the various requirements that receivers of the CAP support under direct payment under Pillar I and some from Pillar II must comply with. Cross-compliance comprises two elements, i.e. Statutory Management Requirements (SMRs) and Good Agricultural and Environmental Conditions (GAECs). SMRs refer to legislative standards in the field of the environment, food safety, animal and crop health, and animal welfare, while GAECs refer to a range of standards on good agricultural and environmental practices. Typical examples for GAECs are (1) soil resource conservation by improving soil organic matter and structure, establishing soil conservation measures to prevent soil erosion; (2)

agricultural landscape, biodiversity and habitat conservation by maintaining and restoring essential landscape characteristics, e.g. through a ban on cutting hedges and trees during the bird breeding and rearing season; and (3) water resource conservation by establishing buffer strips to prevent surface and ground water sources from pollution and implementing efficient irrigation management (EC, updated 18/09/2015; Hart, 2015; Nitsch et al., 2014; Cantore et al., 2011).

4.2 Experience from Germany

4.2.1 Agricultural sector and agri-environmental issues

The agricultural sector in Germany plays a minor role in the economy with a contribution to GDP at around 0.7- 0.8% in the last few years. From the total land area of 35.7168 million hectares, 47% or about 17 million hectares are classified as agricultural land in 2010. Within the agricultural land, 71% is under arable and permanent cropland, while the rest is under permanent pasture. From 2000-2010, reduction of agricultural land at an annual rate of around 1.4% has been observed with a sharp decline in the number of agricultural businesses at around 20.6% in the period of 1999-2007. On the other hand, an increase in average farm size from 36.3 to 45.3 hectares in the same period was recorded (OECD, 2013a; EUROSTAT, modified 11/09/2015).

Even though the decline of agriculture is observed as mentioned above, water resource degradation as a consequence of intensive farming activities, agricultural greenhouse gas emissions, and agricultural landscape and biodiversity conservation are still major national concerns and require effective policy measures to address these issues.

- Water resource degradation

With the reduction in the agricultural sector since 1990, water resource degradation related to agriculture has been decreasing. However, the share of both nitrogen and phosphorus discharges from agriculture has increased accounting for around 60% and 50% of total nitrogen and phosphorous discharges in surface water. In absolute terms, both nitrogen and phosphorous surplus has decreased over the period of 1990-92 to 2002-04. With respect to the nitrogen surplus per hectare, the record at national level is still above the average level of the OECD. In particular, areas with high concentration of livestock farming such as in the Northwest and Southeast, a nitrogen surplus has been found which is more than double the average national level. This is not the case for the phosphorous surplus. A, reduction in pesticide use along with the decrease in agricultural activities has reduced the risk of water pollution. In addition, since 1990, use of certain active substances have been regulated, and various regulatory requirements regarding pesticide use near natural waterbodies have been implemented (OECD, 2008a; 2012).

- Greenhouse gases and air quality

Emissions of agricultural greenhouse gases including nitrous oxide and methane have declined from around 87 to 67 Mt CO_2 equivalent between 1990 and 2010. With regard to nitrous oxide released from agricultural soils and manure management, an almost 20% reduction was largely due to declining nitrogenous fertiliser use. At the same time, a decrease in the number of livestock contributed to more than 20% reduction in

methane emission derived from enteric fermentation and manure management. From the composition of agricultural greenhouse gas emissions, the contribution of nitrous oxide to the total agricultural greenhouse gas emissions was about 61% in 2010, while the rest was methane emission. Reduction of livestock numbers also has contributed to a continuous decrease in ammonia emission. Ammonia emission has been reduced from 113 to 72 kilo tonnes, or around 22% during the period of 1990-2010. Even though a reduction of ammonia has been recorded, among EU member states, Germany was still ranked second after France as ammonia emitter accounting for 15.3% of total EU ammonia emission in 2010 (OECD, 2012; EUROSTAT, modified 11/09/2015).

- Agricultural landscape and biodiversity conservation

Various types of agricultural land use have provided landscape amenity value to the society. Typical agricultural landscapes in rural areas of Germany are characterized as “cultural landscapes” featuring the combination of meadows, fields and forests, and providing habitats for various species of both flora and fauna. Conversion of agricultural land for other purposes (such as commercial, housing, transportation), moving from extensive to intensive agricultural practices (such as intensive tillage, and fertilizer use) have contributed to the destruction of agricultural landscapes and agro-biodiversity. According to the Federal Ministry of Nutrition and Agriculture (Federal Ministry of Food and Agriculture, 2014), the expansion of land use for settlement and transportation purposes is at the rate of approximately 74 hectares per day. To serve this expansion, scarifying of grassland has been observed. Hence, traditional agricultural landscape and biodiversity conservation are major issues of concern requiring effective measures to be addressed by the government (Federal Ministry of Food and Agriculture, 2014; Federal Ministry of Food, Agriculture and Consumer Protection, 2010).

4.2.2 Agri-environmental policy measures

Since Germany is a federal country, the various federal states design and implement their own rural development programs with their respective policy measures. These are generally jointly financed by the states and the EU. Nevertheless, common measures are also defined at the national level and federal states can receive national co-funding when they decide to adopt them. In most cases, these measures form the core of the programs at federal state level (Nitsch et al., 2014). Being supported under the “Second Pillar”-Rural Development Programmes of the Common Agricultural Policy (CAP) in the period of 5 years, three major agri-environmental programs implemented in four different states in Germany and additional agri-environmental policy measures are described as follows;

- The Bavarian Cultural Landscape Programme (Bayerisches Kulturlandschafts programm KULAP)

In Bavaria, key environmental challenges in Bavaria remain climate change, a loss of permanent grassland, nitrate pollution of surface and groundwater bodies, the continued loss of biodiversity, erosion, and land conversion for housing and infrastructure. The Bavarian Cultural Landscape Programme (Bayerisches Kulturlandschafts programm, KULAP) aims at supporting extensive forms of agricultural production which provides positive external impacts on the environment and natural resources including water, air, soil, landscape

and biodiversity conservation. Under the KULAP, various measures with required conditions and supporting fund are listed below (Nitsch et al., 2014);

- Environmentally orientated grassland management: Focussing on permanent grassland, ploughing and area-wide application of chemical pesticide are prohibited. In addition, recording time, quantity and location of slurry-application is also required. Support to farmers is about 50 Euros per hectare per year.
- Promoting extensification in permanent grassland and meadows: Support to farmers at around 120-170 Euros per hectare per year is provided under the conditions of abandonment of mineral fertilizer and yearly grazing or mowing with removal of cut grass. In case of meadows, with the incentive payment at around 280 Euro per hectare per year, farmers must follow a regulation regarding certain periods of mowing and grazing.
- Water resource protection: Incentive payment to famers at around 350 Euros per hectare per year is provided under the conditions of refraining from particular agricultural practices in the areas adjacent to natural water sources including use of fertiliser and pesticide, and ploughing. In addition, grazing with sheep, mowing and removing cut grass is allowed only once per year.
- Soil erosion control: Yearly mowing together with erosion protection are required with the support of 400 and 600 Euros per hectare per year for 35-49% steepness and 50% steepness or more, respectively.
- Agro-ecological management of grassland: An incentive payment of 20 Euros per hectare per year is offered to farmers who agree to implement agro-ecological management practices with reducing or even abandoning agricultural production on set-aside permanent grassland.

- "Compensation Scheme for Market Easing and Landscape Protection" (Marktentlastungs-und Kultur-landschaftsausgleich, MEKA) in Baden-Württemberg, Southwest Germany

Instigated in 1994 and being one of the first payments for agri-environmental services schemes in Germany and the EU, the Compensation Scheme for Market Easing and Landscape Protection (MEKA) aims at delivering agri-environmental public goods and services to society. In this region, agri-environmental issues under concern include soil erosion, and surface and ground water resource degradation, maintenance of agricultural landscape and preservation of species-rich grassland. The program consists of various measures targeting a wide range of local agri-environmental issues including reduction/abandonment of chemical inputs, promoting extensive and environmentally friendly farming practices, and conserving agricultural landscapes and agro-biodiversity at farm level. Some of these measures are described as follows (Troost et al., 2015; Russi et al., 2014; Burton and Schwarz, 2013; Cooper et al., 2009);

- Promotion of environmentally friendly practices to address soil and water quality improvement: Incentive payment is provided for farmers to adopt environmentally friendly manure application and abandon use of chemical herbicides and fertiliser on the whole farm.

- Promoting of crop diversification: Farmers are offered 20 Euros per hectare per year to have at least four crops accounting for a minimum share of 15% of total farm area, with a restriction on 40% of maize production in the area.
- Extensive management of grassland and livestock: Farmers are offered 50 Euros per hectare per year under the condition of abstaining from grassland conversion, mowing at only 5% of committed grassland, and practicing a livestock density that is restricted to 2 livestock units (LUS) per hectare.
- Biodiversity conservation in farmland: Financial support of 60 Euros per hectare per year is provided with the condition that at least 4 out of 28 officially identified plant species are found under the extensive management of grassland areas.
- The objective of avoiding the abandonment of grassland while ensuring extensive management (with restrictions on fertiliser and pesticide use, ploughing, time of cutting, and livestock density). These measures may be combined with additional measures for maintaining grassland on steep hills and an outcome oriented measure which requires farmers to prove the existence of four indicator grassland species from a list specific to the region.
- Promoting extensive grassland management in supporting nature conservation: Farmers are offered 140 Euros per hectare per year to practice extensive management of grassland which would help maintaining cultural landscape and conserving a diverse flora and fauna.

- The PAULa agri-environment schemes (Kennartenprogramme) in Rheinland-Pfalz (Western/South-western Germany)

To serve the objective of enhancing ecosystems related to agriculture, the PAULa agri-environment program is based on combing expert advice and farmers' knowledge and experience in farmland management that delivers public benefits in forms of agro-biodiversity conservation alongside conventional farming practices. Farmers participating in this program have to follow certain requirements. First, the presence of a minimum number of key species in parcels identified and checked by a farm advisor are prerequisite for application approval. Second, certain farming practices are regulated including grazing and/or mowing at least once a year. Third, particular activities in conflict with nature conservation including drainage and the ploughing up of grassland are prohibited. Recording of management activities and monitoring of species are also required under the program. From 2007 to 2013 farmers could get 225 Euros per hectare for grassland with at least four key species and a payment of 275 Euros per hectare for grassland with at least eight key species. Further increases in the payment rates in both categories were expected for the 2014-2020 period (EC, updated 14/01/2016).

- Support payments for organic management

Support payments for organic agriculture funded under Pillar II of the CAP is offered under the three programs mentioned above. In principle, rules and standards are applied similarly across all programs, but amount of financial support and conditions may vary. Area-based financial support is provided to farmers for their benefit forgone and additional costs incurred during the conversion period from conventional to organic agriculture, and cost of maintaining the converted farmland under organic agriculture. In addition, provision of financial

support for costs of organic certification and inspection is also available. Apart from the EU-support, a federal sector-specific support programme, the so-called Federal Scheme for Organic Farming and Other Forms of Sustainable Farming, initiated in 2002, aims at providing supplementary support to create favourable conditions for the expansion of organic agriculture (Sanders et al., 2011; Sanders and Metze, 2011).

- Green direct payments

Green direct payments, funded under the Pillar I of the 2013 CAP reform under the condition of cross-compliance (see details above), are offered to farmers with three main requirements including crop diversification, maintenance of permanent grassland, and ecological focus areas. The number of crops and coverage cropping ratio are the main aspect of crop diversification requirement. Under the arable land applied for green direct payment, at least 2 different crops need to be grown in the area of 10-20 hectares, and at least 3 crops for more than 30 hectares. Grassland which has not been included in crop rotation for at least five years is classified as “permanent grassland”. Extensive grazing system including timing and maximum stocking density is an example of measures practiced under the permanent grassland. Under the requirement of Ecological Focus Areas (EFAs), farmers with an arable land of more than 15 hectares are required to maintain at least 5% as ecological focus area. Ecological management practices include maintaining and restoring landscape features (ponds, hedges, ditches), applying ecological set aside, managing terraces, planting buffer strips, and afforestation. At least one practice has to be applied under the ecological focus areas (Hart, 2015).

- Community measures

In Bavaria, a pilot project aims at maintaining traditional agricultural mountain farming practices, preserving the cultural landscape, marketing agricultural products under an eco-model Hindelang, and supporting tourism in the area. Under this project, almost all farmers in the municipal area of Upper Allgäu have agreed to abandon the use of nitrogen fertilizer and to adopt a livestock density restriction of 1 livestock unit per hectare. In addition, they needed to produce a minimum of 90% of animal feed within the municipal area. Funds are provided by the municipality. In addition to such specific support for mountain areas, the state government of Bavaria has instigated an initiative called “BioRegio Bayern” in 2013, with the objective of doubling the amount of organic produce in Bavaria by 2020. This initiative comprises promotional campaigns and advisory services for both producers and consumers. Other measures include educational programs for farmers, public investments and research, agri-environmental measures, support of ‘model regions’ and converting public canteens to procure organic products from the region The state government of Bavaria has pledged to support the initiative with more than 5 Mio. Euros of additional funding until 2020 (Nitsch et al., 2014).

- Complementary measures

In general, farm advice is provided by extension agencies at the state government level. This includes technical and knowledge aspects related to agri-environmental practices, organic agriculture, and also cross compliance required under the CAP. The local agricultural administration in conjunction with partner organizations provides advisory services regarding farm management and the economic evaluation of specific farm activities. Additional advice is provided by NGOs. A particular form of support is provided by Landcare Associations (LCAs). These

are regional non-profit associations established by local and regional politicians, agricultural producers and nature conservation associations. Though they are not advisory organizations per se, their role is to coordinate and mediate landcare projects and collaborate closely with land managers, local administrations and other stakeholder groups in order to strike a balance between conservation interests and the socio-economic interests of rural communities regarding farming, tourism and other income generating activities (Nitsch et al., 2014; Sanders and Metze, 2011)

4.2.3 Assessment of agri-environmental programs

- Compensation Scheme of MEKA-B4 in Baden-Württemberg, Germany

Introduced in 2000, the MEKA-B4, a part of the MEKA program mentioned earlier, is considered a result-based program aiming at biodiversity conservation in species-rich grassland. The program offers farmers financial payment not only for the adoption of agri-environmental conservation practices such as extensive grassland management, but also for the declaration of preserving biodiversity in their farmland. An assessment of this program is summarized from the study of Russi et al. (2014). Incentive payments have been quite successful particularly in addressing the problem of agricultural land abandonment in upland areas with difficult conditions. Since opportunity costs for upland farmers in these areas are low, moderate payments for maintaining an extensive, eco-friendly form of agriculture can be effective. In addition, farmers' environmental concern and ethical motivation have played an important role enhancing participation in the program, particularly among part-time farmers. It has been observed that farmers that practice extensive animal farming, those that are working only part-time in the agricultural sector or those of older age have a higher propensity of program uptake. Even though the program has achieved its target of farmers' participation during the period of 2007-2013, a decreasing trend is expected in subsequent years due to various factors. Based on stakeholder interviews, the major concern is that financial support offered under the program is considered insufficient in compensating opportunity costs incurred from adopting agri-conservation measures. An increase in opportunity costs of practicing agri-environmental management derived from positive development of agricultural commodity markets could negatively affect the program participation in the future. In addition, the implementation of an energy crop promotion policy, e.g. corn for biogas processing plants, has a direct effect on opportunity cost of land placed under the MEKA program. Hence, an increase in incentive payments reflecting incurred opportunity costs ensuring economic sustainability of agri-conservation management has been recommended by various stakeholders involved in the program (Russi et al., 2014).

- Support of organic farming in Germany

Direct payments supporting organic farming in Germany are provided through the EU programs. On top of that, additional funds, research and information provision, and technical assistance are provided under federal and state programs. An assessment of support for organic farming is based on the report of Sanders et al. (2011). A continuous increase in organic farming areas from 354,171 2.1 hectares accounting for 2.1% of total agricultural land in 1996 to 1,047,633 hectares or about 6.3% in 2014 has been recorded. In the same period, the number of organic farms has increased from 7,353 (or about 1.3% of total number of farms) to 23,398 accounting for about 8.2% (Federal Ministry of Food and Agriculture, 2016). This indicates a successful

development of organic farming in Germany. The area-based incentive payment under the EU program in supporting conversion and maintenance of organic farming is considered as a necessary basic factor contributing to the program uptake. Additional supports from federal and states have played crucial roles enhancing the long-term development of organic farming in Germany. Example of those supports are certification costs, training and advisory costs, provision of information, research and institutional facilities. From the farmers' point of view, 91% of the surveyed organic farmers stated that the incentive payments were important for farm profitability (Sanders et al., 2011). This is supported by the dramatic increase in farm profit plus labour cost from around less than 20,000 Euro per man work unit (MWU) in 1995/96 to more than 30,000 Euro per MWU in 2013/14. Comparable conventional farms earned, on average, in the 2014/15 marketing year profits plus labour costs per MWU of 31,533 Euros. Thus, the average income of the organic test farms exceeded the income of the conventional reference farms by around 1,700 Euros or 5 percent (Federal Ministry of Food and Agriculture, 2016).

4.3 Experience from the United Kingdom

4.3.1 Agricultural sector and agri-environmental issues

Among a total land area of 24.361 million hectares, 71% or about 17.3 million hectares are classified as utilized agricultural land in 2013. Permanent grassland accounts for 56% of the utilized agricultural land, while 36% is for arable area dominated by cereals (such as wheat and barley) and oilseeds (including linseed and borage). Contribution of the agricultural sector to GDP is quite small accounting for only around 0.7-0.8% during the period of 2004-2013 (Department for Environment, Food and Rural Affairs et al., 2012). Various agri-environmental issues in the UK are briefly described as follows:

- Soil degradation

Soil degradation is a particular concern in the arable, mixed and intensive grassland areas. 25% of England and Wales have been classified under moderate to very high risk of erosion, as arable and grazing activities are found predominantly. Soil being left uncovered during the winter season has also contributed to soil erosion in the UK. As soil erosion causes not only on-site impact (decrease in productivity due to soil degradation), off-site effects in forms of water quality deterioration from agriculture nutrient run-off, sedimentation are also a major concern in the UK (Jone, Silock and Uetake, 2015; OECD, 2008a).

- Water resource degradation

Degradation of water resources derived from agricultural runoff is considered a main concern in the UK. Even though a decline of nitrogen and phosphorus balances by 30% and 54% respectively has been observed due to the reduction of fertilizer application in crop production and on grassland in during the period of 1990-2009, agricultural run-off is still the main source of nitrogen and phosphorous discharged into natural waterways. Agriculture accounts for 60% of total discharge of nitrogen, and around 20-30% of total discharge of phosphorous. Many agricultural areas in the UK exceed the recommended drinking water limits for nitrate and phosphorous in surface water sources, giving the country the second highest score among OECD countries. However, the situation has improved with regards to pesticide contamination in water resources over the last

25 years. A 56% reduction in pesticide sale during the period of 1990-2009 together with an expansion of adoption of environmentally practices have contributed to a decrease in water pollution from pesticides. In addition, change in regulatory control by revoking old high-dose pesticides and replacing them by pesticides with lower dose of application have also resulted in lower use of pesticide. With regard to water quantity, irrigation is one of the main water users in some areas in UK where agriculture activities are predominant such as in the South East and East of England. Even though the amount of water use for irrigation has dropped during the period of 1990/92-2006/8, the share of freshwater withdrawal for agriculture has increased from 12% to 15% over the same period (Jones, Silock and Uetake, 2015; OECD, 2013a; Department for Environment, Food and Rural Affairs et al, 2012;).

- Greenhouse gas emission and air quality

As livestock farming and crop production in the UK is in the declining stage, two major agricultural greenhouse gases, nitrous oxide (N_x0) and methane (CH_4), are also decreasing. During the period of 1990-210, a 20% decrease of these two greenhouse gases was observed. However, agriculture still remains the main emitter of nitrous oxide and methane, accounting for 84%, and 43% of the total emission of these two gases respectively in 2011. With regard to air pollution, agriculture is the main source of ammonia emission derived from livestock production. Due to the reduction in livestock numbers, 24% decrease in ammonia emission was observed during the period of 1990-2011. This means a reduction of the share of ammonia emission from agriculture from 93% in 1990 to 86% in 2011 (Jones, Silock and Uetake, 2015; OECD, 2013a; Department for Environment, Food and Rural Affairs et al., 2012).

- Agricultural landscape and biodiversity conservation

Agricultural landscape is considered a predominant landscape in the United Kingdom providing amenity value to society. A wide range of agricultural landscapes including intensive arable cropping landscapes, permanent and temporary grassland, lowland and upland agriculture which are located in different parts of the country. Man-made features, including stonewalls and hedges in farmland, have also provided cultural value attached to agricultural landscape. Maintaining such features is required to enhance the value of cultural landscapes in the UK. In addition, different natural conditions and varieties of human activities on farmland have provided habitats for various species. On the other hand, changes in agricultural practices, such as moving toward more intensive agriculture and afforestation in farmland also put pressure on biodiversity and habitat of wild species (Jones, Silock and Uetake, 2015; OECD, 2008a).

4.3.2 Agri-environmental policy measures

To address agri-environmental issues, the United Kingdom relies very much on providing incentive payments to encourage provision of agri-environmental public goods and services by voluntarily adopting environmentally friendly practices. A wide range of incentive payments is offered under agri-environmental programs funded by the European Union. Under this circumstance, cross compliance is required by the Common Agricultural Policy (CAP). Hence, incentive payments offered under a requirement of cross compliance are classified as “cross compliance measures” in this report.

- Cross-compliance measures

Cross compliance refers to a set of rules including ‘Statutory Management Requirements’ (SMRs) and ‘Good Agricultural and Environmental Conditions’ (GAECs) covering public, animal and plant health; environment, climate change and good agricultural condition of land; and animal welfare. In the UK, cross compliance is applied under the agri-environmental payment programs funded under the European Union including the Basic Payment Scheme, the Countryside Productivity Scheme, and the Countryside Stewardship (Department for Environment, Food and Rural Affairs, 2016). Selected financial payments or grants at farm level are described as follows;

- Basic Payment Scheme (BPS): greening payment

The Basic Payment Scheme is considered the biggest scheme funded under the EU, and its application BPS varies within the UK. Greening payment in England under the BPS provides farmers with financial support based on three main conditions. First, to receive payments for ecological focus areas (EFAs) on arable land, farmers with more than 15 hectares of arable land must have ‘ecological focus areas’ (EFAs) on their land including buffer strips, cover crops, nitrogen-fixing crops, fallow land, hedges. Second, payments for crop diversification on arable land requires farmers with 10 hectares or more of arable land to grow at least 2 or 3 different crops. Information regarding types of crops that are eligible is provided in the program. Third, payment for permanent grassland required farmers to maintain the grassland under the restriction of not falling below 5% (Rural Payments Agency, 2015)

- Countryside Productivity Scheme: capital grants for water resource conservation

Efficient irrigation system is considered an important aspect in saving water resources. Under the Countryside Productivity Scheme, financial support is provided to farmers for an investment to improve the irrigation and reservoir system in their farmland leading to an annual water saving at least 5%. Project grants are intended to make irrigation more efficient. The project must lead to annual water savings of at least 5% (Rural Payments Agency, 2015)

- Countryside Stewardship Scheme

The Countryside Stewardship Scheme aims at providing financial incentives to farmers to protect and enhance the natural resources conservation including water, soil, air, landscape and biodiversity. A range of management options and one-off payments towards the costs of certain capital items or activities. The scheme has replaced Environmental Stewardship, English Woodland Grant Scheme, and capital grants from the Catchment Sensitive Farming programme. The Countryside Stewardship offers three main elements of grants. Mid-Tier grants aim at addressing environmental issues deriving from farm activities such as reducing diffuse water pollution, improving farm environment for biodiversity conservation. High-Tier grants focus on environmental significant areas. Various management options and capital items are provided for farmers to apply under the Mid-Tier and High-Tier grants which are multi-year grants. Capital grants or one-off grants are to support the provision of

agri-environmental goods and services (Natural England, 2015). Examples of grants under this schemes are provided below.

- Grants for organic conversion

Organic conversion is one among various options provided under Mid-Tier and High-Tier grants of the Countryside Stewardship Scheme. Annual payments of 175 British pounds per hectare for a maximum of 24 months are provided to support farmers to convert from conventional to organic farming. Certain rules applied under this grant include following an approved conversion plan under an organic control body, complying with organic standards, and completing full conversion by the end of the agreement.

- Capital grants for reducing agricultural water pollution

To address water pollution generated by agriculture, farms located under selected areas – so-called priority catchments – are eligible to apply for financial support in solving agricultural pollution at site. Grants are provided for capital works including installation of wastewater collection facilities on dairy farms, installing drinking troughs for livestock, and fencing natural water courses.

- Capital grants for hedgerows and boundaries

Hedgerows and stonewalls are not just for farmland demarcation and erosion control, but are considered predominant features of an agricultural landscape and biodiversity habitats. Grants are offered under the Countryside Stewardship Scheme as incentives to farmers to maintain and restore hedgerows and stonewalls for their provision of agri-environmental public goods and services to society.

- Complementary measures

Various types of technical assistance and knowledge provision are offered to farmers as complementary measures supporting the delivery of agri-environmental goods and services. The Farm Advice Service (FAS) funded by the Department for Environment, Food and Rural Affairs provide farmers with free advises on cross-compliance, greening (under the Basic Payment Scheme), and the European Directives on both water protection and sustainable pesticide use. This support is a crucial factor supporting farmers to successfully comply with the policy requirement which consequently deliver agri-environmental goods and services to the society. Catchment Sensitive Farming (CSF), the project under the Natural England in partnership with the Environment Agency and the Department for Environment, Food and Rural Affairs, aims at raising awareness in diffuse water pollution from agriculture (DWPA). CSF provides training and advisory services to farmers to provide agri-environmental goods and services by improving their farming practices such as manure, nutrient, and pesticide management, soil condition and farm infrastructure (Jones, Silcock and Uetake, 2015; Natural England, 2012).

4.3.3 Assessment of agri-environmental programs

- Incentive payments for agri-environmental conservation in the UK

According to Keenlayside et al. (2011), the agri-environmental scheme implemented in the UK can be characterized as a self-selection scheme with a number of options in agri-conservation management practices. A flat-rate of incentive payment per hectare is offered for each option under certain requirements of minimum area-based application. Major factors determining successful uptake of the agri-environmental schemes are summarized based on the studies of Austin et al. (2015), Wissman et al. (2013), Keenlayside et al. (2011), and Hodge and Reader (2010). Compatibility of the promoted conservation practices and farmers' existing farming practices are considered the most important determinant element of program uptake (Keenlayside et al., 2011). For example, a conservation practice required to be implemented in the productive farmland area is less preferred by farmers compared to one which can be applied on non-productive parts of the farmland. Linked to this factor, opportunity costs incurred from promoted conservation practices have a strong effect on farmers' adoption behavior. Conservation practices with low cost of implementation have a higher likelihood to be adopted by farmers even though such practices are considered less effective in providing environmental benefits (Austin et al., 2015). In addition, the crop price has been found to be a factor determining conservation adoption as it directly affects benefit foregone from taking away farmland for implementation of conservation measures (Hodge and Reader, 2010). With regard to farm size, Wissman et al. (2013) state that promoted conservation measures which required sacrificing of space for implementation are not compatible with the condition of smaller farms in the UK, which are usually under intensive farming. Furthermore, farmers' environmental concern positively enhances the adoption of agri-conservation practices.

- Organic agri-environment scheme in UK

Under the agri-environmental scheme in the UK, three main elements of support that are provided for organic agriculture are (1) area-based flat rate payments for converting from conventional to organic practice, (2) maintaining organic certification, and (3) implementing environmental conservation measures in farmland (National Audit Office, 2010). Based on a report of the National Audit Office (2010), the support provided through the costly and time-consuming process of organic conversion is considered the most important factor enhancing the program uptake particularly for livestock, dairy and arable farming. However, less effect is found for land-intensive farming. With regard to the element of environmental conservation practices, options with simple implementation and maintenance, those that are less costly, and those with less impact on farming business (such as hedgerow management and grassland with low/very low fertilizer input) show a particularly high uptake by farmers. However, these option do not always deliver the best environmental impact. Complication in rules and regulation required for the organic support is a crucial factor discouraging farmers' participation in the program. This is demonstrated by the decline in number of new applicants observed during the period of 2005-2009 (National Audit Office, 2010).

- Catchment Sensitive Farming (CSF) in England

Launched in 2005, the Catchment Sensitive Farming program is considered as a complementary program providing training and advice to famers for environmental performance improvement of their farms and also to

raise their awareness regarding water resource degradation deriving from diffuse agricultural pollution in priority catchments. The assessment of the CSF program is based on the report provided by CSF Evidence Team (2014). Based on the report, 167,788 conservation practices have been advised to 16,133 farms in the targeted catchments resulting in a positive impact on surface and ground water resources. Through the environmental impact monitoring system, a reduction of nutrient leaching, pesticide loading and sedimentation derived from various advised environmental conservation practices have been observed. This suggests a positive assessment based on outcome and impact of the program. In addition, participating farmers consider the CFS program as the most important initiative in providing assistance needed for water pollution reduction. A combination of building trust and close working relationship between farmers and program staff is considered a crucial factor contributing to successful program implementation (CSF Evidence Team, 2014).

In sum, agri-environmental policy measures implemented in Germany and the United Kingdom are primarily classified as cross-compliance measures under the requirements of the CAP reform. Financial incentives are provided to both farm and community levels to promote provision of agri-environmental public goods and services through a wide range of practices including environmentally friendly practices to address soil and water quality, organic farming, agricultural landscape and biodiversity conservation. The successful implementation of the agri-environmental measures in Germany and the UK is derived primarily from a combination of both the provision of financial incentive and complementary measures referring to training, expert advises, information and institutional support.

Chapter 5

Experiences from the United States of America and Canada

This chapter provides review of agri-environmental policy measures implemented in the United States of America (USA) and Canada. Prior to that, performance of agriculture sector and agri-environmental issues are briefly presented. An assessment of selected policy measures from each country are provided based on literature reviews.

5.1 Experience from the USA

5.1.1 The US agricultural sector and agri-environmental issues

The United States is one of the most important producers and major exporters of agricultural products in the world. Yet the contribution of the agricultural sector to GDP has decreased from 1.6% to 1.3% in the period of 1995-2013. Within the agricultural sector, the share of crop production from grains, oilseeds, fruits and vegetables was around 60%, and the rest was from livestock production, mostly beef, dairy, and poultry in the same period (OECD, 2015). In the US, the agricultural sector accounted for about 44% of the total land area and around 40% of water consumption in 2013. As the major user of land and water, agricultural activities have imposed negative impacts onto soil and water resources to various degrees. The major agri-environmental issues addressed by the government in both federal and state levels are water and soil resources degradation and agricultural landscape and biodiversity conservation.

- Water resource degradation

Agriculture point and non-point sources are considered the main polluters causing water resource degradation in the US. Chemicals and nutrient runoff and erosion from cropland posing negative impact onto surface and ground water quality refer to non-point source water pollution, while wastewater discharged from dairy, poultry and other livestock farming are considered as point source water pollution. Negative impacts of agricultural pollution from both point and non-point sources are generally observed in the areas with high concentration of crop and livestock farming (Shortle et al., 2012). According to data from the National Water Quality Assessment, the principal source of adverse impacts on water quality on surveyed rivers and streams is agricultural nonpoint source (NPS) pollution. It is the third largest pollution source for lakes and the second largest source of deterioration of wetlands. In addition, it is a major driver of contamination of surveyed estuaries and ground water (USEPA, updated 31/10/2015).

- Land resource degradation

Land resource degradation caused by agricultural activities includes agro-chemical contamination in soils and erosion from agriculture land conversion. While the average soil erosion rate in the US croplands is considered relatively low and erosion rates in the United States have dropped from an average 16.4 t/ha/year in 1982 to 10.8 t/ha/year in 2007 (Pimentel and Burgess, 2013; Natural Resources Conservation Service, 2010;), soil erosion is still considered a problematic issue in some areas of intensive crop productions and mono-culture

practices. In Iowa State, areas under the Corn Belt Regions, its rolling topography together with corn and soybean product are considered as causes of high erosion rate at 11.5 ton/hectare/year (Pimentel and Burgess, 2013).

- Agricultural landscape and biodiversity conservation

Conversion of agricultural land to other non-agricultural purposes have caused concern on the loss of amenity value attached to agricultural landscape. It was reported that 11 million acres of cropland was converted to development during the period of 1982-2007. On the other hand, land conversion for agricultural activities particularly native prairie land negatively affects ecosystems and biodiversity of the native grasslands. (OECD, 2015, Shortle and Uetake, 2015)

5.1.2 The US agri-environmental policy measures

The United States Department of Agriculture (USDA), a federal agency, has played the most important role addressing agri-environmental issues. Under the USDA agri-environmental program, four different policy approaches are established including 1) to encourage farmers to convert from conventional to more environmentally friendly practices, 2) to motivate farmers to convert agricultural land to grassland or forest in sensitive environmental areas, 3) to discourage agriculture development in environmental sensitive areas, and 4) to limit conversion of agriculture land to other purposes. A wide range of policy measures are based on provision of economic incentives, regulatory requirements, and cross-compliance. In addition, complementary measures providing technical and knowledge assistance are also implemented in support of eco-friendly agriculture practices (OECD, 2015, Shortle and Uetake, 2015).

- Incentive payments based on conservation practices

Established in 1996 under the USDA program, the Environmental Quality Incentives Program (EQIP) aims at solving water quality degradation from agriculture non-point source water pollution by implementing performance-based payment measures. Financial incentives are offered to farmers to adopt and maintain environmental conservation practices in order to solve the problem of nitrogen and phosphorous runoff from croplands. In addition, to address nutrient run-off, another major source of pollution imposed onto natural water bodies, funding support is also provided for manure and nutrient management for livestock farming. Addressing water quantity issues related to agriculture, EQIP also provides technical and financial assistance to farmers for water conservation measures (Shortle et al., 2012).

- Incentive payment based on conservation performance

The Conservation Stewardship Program (CSP) under the USDA program provides financial incentives to farmers based on conservation performance. While financial incentives provided under the EQIP are based on fixed practices (as mentioned above), the CSP focusses on conservation performance. Conservation performance covers not only activities related to the improvement, maintenance, and management of existing conservation measures in the farmlands, but also the adoption of additional conservation practices (Ribaudo, 2012, cited in Shortle and Uetake, 2015). Under the CSP, the relative environmental benefits of conservation

performances indicated in established scoring tables are used for participant selection and payment determination (Shortle and Uetake, 2015).

- Incentive payments based on agricultural land retirement

The Conservation Reserve Program (CRP), with the largest budget under the USDA agri-environmental program, was launched in the mid-1980s offering payment for agricultural land retirement. In some environmental sensitive areas such as wildlife hotspots, sources of water resources, payments are offered as incentives to farmers to convert agricultural land to grassland or forest. A bidding system is applied to select participating farmers and determine financial payments. The bid is evaluated based on costs and benefits accrued from agricultural retirement which refers to on-farm and off-farm impacts including reduction in soil erosion, improving water quality from elimination of agricultural nutrient leaching, enhancing flora and fauna habitat conservation, and air quality improvement from wind erosion reduction. Plot size and duration of contract are also important aspects of the agricultural land retirement bidding system (Shortle and Uetake, 2015).

- Market-based measure: water quality trading program

In the US, market-based measures are applied to address water quality issues related to agricultural non-point source water pollution. Nutrient leaching from agriculture is considered the main polluter. For instance, severe damage was recorded to the ecosystem of the Chesapeake Bay, the largest estuary in the US. Pennsylvania's agricultural sector was the source of 56% of the estimated nitrogen and 44% of the estimated phosphorus entering the bay. In 2005, a so-called Nutrient Trading Program was established in Virginia, and Pennsylvania, and in Maryland in 2008. Under this trading program, agricultural non-point sources are allowed to participate by selling their Emission Reduction Credits (ERCs) to other point sources. Incentives are provided via the trading system to farmers who are willing to improve agricultural nutrient management. In Pennsylvania, farmers earn ERCs for nitrogen and phosphorous from installation of Best Management Practices (BMPs) for nutrient flow reduction into the Bay (Shortle, 2012; Branosky et al. 2011).

- Incentive payments for long-term agricultural land conservation

The newly launched program called "The Agricultural Conservation Easement Program (ACEP)" offers farmers funding for long-term easements of agricultural land. The purposes of this programs are not only to protect agricultural lands from conversion to non-agricultural activities, but also to preserve wetland on farms (Shortle and Uetake, 2015).

- Disincentive measures for protection of native prairie land

Protection of native ecosystem and various wildlife under prairie land has been the main purpose for the introduction of "the Sodsaver" program in 2014. Disincentive measures imposed on conversion of native grassland for agricultural purposes are a reduction in crop insurance premium subsidies (Shortle and Uetake, 2015).

- Cross-compliance measures for soil and wetland conservation

Cross-compliance measures are implemented under two main programs. Under the Wetland Conservation Program, the so-called “Swampbuster”, incentive payments are provided to farmers under the condition of performing certain conservation practices. For example, farmers are required to refrain from draining wetlands if they want to become eligible to participate in the program. In the designated high erosion prone areas, approved soil conservation practices need to be adopted by farmers to be eligible to participate in the “Sodbuster” program with the purpose of soil loss reduction and wetland conservation. Various benefits are provided such as loans and disaster assistance payments as well as crop insurance premium subsidies (Shortle and Utetake, 2015).

- Regulatory requirements: technological-based standard setting

Various regulatory requirements are put in place to address environmental problems related to agriculture. The Clean Water Act, the Environmental Pesticide Control Act and the Insecticide Act are the main legislative frameworks issued at the federal level and handled by the United State Environmental Protection Agency (USEPA). Under the Clean Water Act, a regulatory requirement to control agricultural point source water pollution is implemented using technology-based effluent limits. Wastewater discharged from large concentrated animal feeding firms as point sources are regulated by installation of required treatment facilities and following effluent limits. The use of chemical pesticides and insecticides in farming is strictly regulated under the Environmental Pesticide Control Act and Insecticide Act (Shortle el al., 2012).

- Complementary measures

Various educational, technical assistance programs are provided by federal, state and local governments as complementary measures facilitating provision of agri-environmental public goods and services. To promote organic agriculture, governmental funds are provided to assist organic farmers in various aspects including acquiring organic certification, and also to expand research on organic agriculture. Furthermore, crop insurance is provided for organic farmers for their risk management which would help facilitate the expanding of organic agriculture farming in the US (OECD, 2015).

5.1.3 Assessment of agri-environmental programs

- Conservation Reserve Program (CRP) and Environmental Quality Incentives Program (EQIP) in USA

Initiated in 1985, the Conservation Reserve Program (CRP) offers farmers long-term contracts of around 10-15 years for cropland retirement. Financial support provided under this program is determined by a “Benefits Index” (EBI) accounting for wide ranges of environmental benefits and contract costs. The CRP with the funding allocated at around 1.8 billion USD in 2005 is one of the largest US agri-environmental programs. In 2005, it was reported that land areas under the CRP was about 35.9 million acres or 14.5 million hectares (Claassen et al., 2008). The study of Mishra and Khanal (2013) provides an analysis of various important factors including farmers’ characteristics and farm physical and financial attributes determining farmers’ participation in the CRP. Age, education and the off-farm primary occupation positively affect the program participation. Large farm size shows a positive impact on program participation, while negative effect is found from farm location in proximity

of urban areas. Farmers with primary activities including livestock and high-value crop farming decrease the likelihood in CRP participation. In addition, farms possessing high soil productivity are less likely to participate in the CRP program. Farm financial performance represented by current and debt-to-asset ratios significantly poses negative impact on farmers' participation in the CRP program. This could be explained by the fact that farms with high liquidity would find the long-term commitment under CRP unattractive, and high debt-to-asset-ratio showing high long-term financial obligation which generally discourages farmers' participation in the program (Mishra and Khanal, 2013).

Introduced in 1996, the Environmental Quality Incentives Program (EQIP) offers an incentive mechanism in the form of cost-sharing and technical assistance to farmers for the adoption of environmentally friendly practices on farmland. Among agri-environmental programs implemented in the US, EQIP is considered the second largest one after the CRP in terms of budget allocation, which amounted to around 1 billion USD in 2005 (Claassen et al., 2008). During the fiscal years of 2008-2012, EQIP funding has been increased by 7.25 billion USD (Mishra and Khanal, 2013). The dramatic increase in funding suggests a positive assessment of program performance. The study by Mishra and Khanal (2013) provides in-depth analysis on factors determining farmers' participation in the EQIP program. Apart from general farmers' and farm physical characteristics, farm financial characteristics are examined in this study. Short-term financial performance refers to liquidity represented by current ratio, and solvency measured in the form of debt-to-asset ratio represents long-term financial obligation. The study finds that high solvency or debt-to-asset ratio negatively affects participation in the EQIP program. This can be seen from the cost-sharing requirement of the program as the EQIP requires 50% financial contribution from participating farmers. With regard to farmers' characteristics, education positively enhances the EQIP participation, while farmers with off-farm activities as the primary occupation are less likely to participate in the program. The larger the farm size and the higher the level of soil fertility in the farmland the more likely farmers are to participate. Compared to other types of farming, livestock farming dominates in the program participation. This could be explained by the fact that livestock farming has been the main focus of the program. In addition, incentives provided by the EQIP positively determine farmers' participation in this program (Mishra and Khanal, 2013).

- Pennsylvania Nutrient Credit Trading Program (PANCTP) in USA

Established in 2005, Pennsylvania Nutrient Credit Trading Program (PANCTP) aims at reducing nutrient loading into the Chesapeake Bay. It offers farmers as non-point sources to trade emission reduction credits (ERCs) acquired from establishing best management practices for nitrogen and phosphorus control (Shortle, 2012). Under the trading program, ERCs acquired by uncapped agricultural nonpoint sources are expected to be traded to capped point sources (Shortle, 2012). Since 2007 nearly 89,000 certified nitrogen credits have been generated from agricultural non-point source implementing BMPs practices, cover crops and no-till in particular (Latane and Stephenson, 2011). This shows active farmers' participation in the trading program as opportunity to acquire financial benefits is provided. However, there has been a limited transaction taken place under the ERCs trading particularly from non-point sources. Detailed information can be obtained from OECD (2012). Various concerns regarding nonpoint source's involvement in the trading program are summarized based on

the study by STAC (2013). Installation and/or practicing BMPs can be observed, but there are difficulties and uncertainties in quantifying loads from non-point sources. In addition, continuation of implementation and maintenance of BMPs is considered an issue that needs to be strictly monitored as non-compliance cannot be excluded. Hence, incorporating these concerns into program design and rules are recommended for successful implementation of the trading program. Moreover, an important recommendation derived from STAC (2013) is that establishing and maintaining close social interaction between program staff and farmers is a crucial factor enhancing farmers' participation with proper BMPs implementation.

5.2 Experiences from Canada

5.2.1 Canada's agricultural performance and agri-environmental issues

Among OECD countries, Canada is considered a country with high GDP, which increased dramatically from 590 to 1,826 billion USD in the period of 1995-2013. The contribution of the agricultural sector to GDP decreased from 2.9 to 1.6% over the same period. However, agriculture still remains an important sector to the economy, for some regions such as Alberta, Manitoba in particular. According to the 2011 Census of Agriculture, a 4.1% decrease in total farm area was observed, but there was an increase in average farm size of 6.9% during the period of 2006 -2011. In 2011, the total farm area was recorded at 160.2 million acres with an average farm size of 778 acres. The Canadian agricultural sector is still dominated by field crop production, while livestock and dairy in particular are showing an increasing trend (OECD, 2015; Agriculture and Agri-food Canada, 2515; Statistics Canada, modified 25/01/2016). Various agri-environmental issues in Canada are described as follows;

- Soil degradation

Based on an assessment at national level, during the period of 1981-2006 an overall reduction of soil erosion was recorded, and 80% of cropland area was classified under very low risk class in 2006. However, under the country's particular topography with high slopes of more than 10% particularly in the eastern part of the country, serious erosion from agriculture activities continues to occur. With respect to cropping systems in the country, potato and sugar beet productions with intensive tillage practices have contributed to a high risk of soil erosion. For example, soil erosion is considered serious in potato production in New Brunswick. In this particular case, a combination of topographical characteristics of rolling area with soil properties of coarse texture, together with intensive tillage of potato production have severely contributed to soil degradation (Eilers et al. (eds), 2010; Agriculture and Agri-food Canada, modified 23/11/2015).

- Water resource degradation

Water resource degradation is considered a serious threat to the country with a declining trend of water resource performance based on the national assessment during the period of 1981-2006. Based on the indicator of risk of water contamination by Phosphorous (IROWC-P), while in 1981, 89% of the farmland was in the very low IROWC-P risk class, the figure went down to 33% in 2006. Increase in fertilizer and manure application to serve intensive cropping production and expansion of livestock is the main cause of water resource degradation with high levels of nutrient influx, particularly nitrogen and phosphorous. Nitrogen fertilizer use increased by

35%, while use of phosphorous rose by 11% between the periods of 1990-1992 and 2002-2004. Canada is considered a water-resource rich country, but under the circumstance of a continuous increase of irrigation demand from the expansion of agricultural activities, water shortage has emerged as a problem in some regions. For example, more than 40% of farms in British Columbia reported surface and ground water shortage for irrigation (Eilers et al. (eds), 2010; OECD, 2008a).

- Air quality

The agricultural sector contributes to around 10% of greenhouse gas emissions in Canada. Increase in livestock farming and intensification of crop production with continuous increase in fertilizer use lead to an upward trend of nitrous oxide and methane emissions. In addition, increase in livestock operations across the country during the period of 2001-2006 also contributed to air quality degradation from ammonia emissions (Eilers et al. (eds), 2010).

- Agricultural landscape and biodiversity conservation

Canada's agricultural landscapes are characterized by a mosaic of cultivated, natural and semi-natural land and much of the land has been a wildlife habitat. While some agro-ecosystems support many of Canada's native species, dynamic agricultural land use can have major adverse impacts on wildlife. Wildlife habitat on farmland is threatened by the conversion of natural and semi-natural land to cropland, agricultural intensification and the loss of landscape diversity. According to an assessment at national level, the average habitat capacity on agricultural land declined between 1986 and 2006. This national trend can differ from one region to another contingent upon the proportion of natural and semi-natural land cover in the wider landscape (Eilers et al. (eds), 2010).

5.2.2 Agri-environmental policy measures

In Canada, agri-environmental policy objectives and strategic outcomes are jointly developed under the cooperation between, federal, provincial/territorial (FPT) governments. A wide range of policy measures derived from both economic-incentive and command-and-control approaches are implemented by provincial governments.

- Incentive payments for Beneficial Management Practices (BMPs)

Developed by the FTP government and implemented under the provincial level, the Environmental Stewardship Incentive programs aims at addressing agri-environmental issues by providing incentive payments for farmers who agree to adopt best management practices with the required conditions of participating in the Environmental Farm Plan (EFP) programs. EEP focuses on providing knowledge and enhancing awareness in agri-environmental risks and benefits to famers via an interaction process with EEP personnel and supporting experts. In addition, various supplementary documents such as manuals and factsheets are also provided. Based on the knowledge and expertise provided under the EEP, farmers are expected to provide an agri-environmental assessment of current farming practices and the development of an action plan for risk mitigation. Adoption of beneficial management practices (BMPs) is supported under the Environmental Stewardship

Incentive Programs in the form of cost-share payments to farmers with an approved EEP (OECD, 2515; Schmidt et al., 2012; Agriculture and Agri-Food Cananda, 2009). BMPs are commonly defined as practices in support of economic and environmental sustainability at farm level. More definitions of BMPs can be found in Brethour et al. (2007). Implemented in Saskatchewan province, cost-sharing support is provided for the adoption of BMPs that aim at improving or maintaining quality of soil, water, air or biodiversity resources at farm level. The beneficial management practices (BMPs) include improved nutrient management and manure storage, establishing soil conservation and erosion controls, applying integrated pest management (Saskatchewan Ministry of Agriculture, 2012).

- Regulatory requirements for agri-pollution control

In Canada, various economic incentive measures are employed to encourage voluntary provision of positive public goods and services from agriculture as mentioned above. Regulatory requirements are considered compulsory measures addressing negative externalities from agriculture. Various regulatory requirements are imposed on farmers to control pollution derived from farming activities potentially causing surface and ground water resource degradation. Under the Nutrient Management Act, certain nutrient management practices and documentation of application of such practices are required for livestock farming. Storage and application of manure, application of non-agricultural materials, and establishment of appropriated on-farm waste treatment facilities are regulated. In addition, limitation on livestock numbers and fencing and drainage restrictions are applied in some cases. To deal with nutrient leaching from farmlands, farmers are required to established buffer strips around surface and ground water sources to water courses and groundwater sources. Some agricultural practices are banned, including farming on over 11% sloping land and less than 3-year rotation system. Farming activities within a 10-meter area of a water source are also prohibited to address erosion and water resource degradation from farming activities (Schmidt et al., 2012; OECD, 2015)

- Community-based measures: Agri-environmental Group Planning (AEGP)

Introduced in 2005, the AEGP is a collective-action based program offered by the provincial government of Saskatchewan. It aims at addressing agri-environmental negative impacts by providing technical and financial support to farmers' groups for environmental risk assessment and adoption of so-called Beneficial Management Practices (BMPs). Supports under the AEGP focus mainly on provision of common agri-environmental good and services within a geographical area, such as a watershed. Improving water quality in watershed areas has been strongly supported by the Government of Saskatchewan (OECD, 2013b).

- Complementary measures

In most programs mentioned earlier, technical assistance and knowledge are practically provided as complementary measures alongside program implementation. At the federal level, the Sustainable Agriculture Environmental Systems (SAGES) initiative provides fund for research and development to create BMPs, to provide policy options and knowledge on impact and adaptation alternatives (OECD, 2015). With respect to agricultural greenhouse gas emission issues, the Agricultural Greenhouse Gases Program (AGGP) focuses on enhancing knowledge and accessibilities of BMPs for farmland and livestock management which help mitigating

greenhouse gas emissions. Under this program, creation and implementation of knowledge and technological transfer to farmers are the main purpose (OECD, 2015).

Apart from agri-environmental policy measures implemented by Canadian government, non-government organizations under the cooperation with government agencies have play important role implementing various projects aim at provision of pubic environmental goods and services. Example of these programs are; Implemented in Ontario, Waterloo/Wellington County, incentive payments for tree planting in the farmland are provided to farmers at the rate of C$250/acre for 3 years and C$100/acre for 4 more years to support long term water management plans at the farm level. This program is managed by the Grand River Conservation Authority. A reverse auction is employed under the Wetland Auctions Program managed by The Assiniboine Watershed Stewardship Association (AWSA) along with Ducks Unlimited Canada and the Saskatchewan Watershed Authority in Saskatchewan for wetland and habitat restoration providing compensation for farmers for their efforts and costs incurred from restoring wetlands in their fields. Provincial and federal acts on conservation of endangered species encourage farmers to provide habitat for endangered species by offering cost-share payment for costs incurred (Schmidt et al., 2012). Alternative Land Use Services (ALUS), a community-based program, offers incentive payments to farmers for their efforts in provision of positive environmental good and services through the protection of sensitive land such as wetland, riparian and upland. The basic idea of ALUS has been applied and implemented by various provinces with different targets and support according to conditions in each province. In most cases, these sensitive areas are not high-yielding agricultural lands. Payments are in the form of cost sharing of expenses incurred for program development and establishment. In addition, rates of payment to farmers are varied according to quality of land offered for restoration (Schmidt et al., 2012). Further information on ALUS programs implemented across the country can be found at the ALUS's website (http://www.alus.ca/).

5.2.3 Assessment of agri-environmental programs

- Environmental Farm Plan (EFP) and incentive payments for Beneficial Management Practices (BMPs) in Canada

Since the first implementation as a pilot project in 1990s, the Environmental Farm Plan has focused on encouraging farmers to assess environmental risks and develop farm plans to address their on-farm agri-environmental issues under financial and technical support from the government. The program has been recognized for contributing to awareness and knowledge enhancement in environmental conservation of farmers and farming communities. According to Centre for Environmental Stewardship and Conservation (2009 cited in Holmes et al. 2011), participation in this program is estimated at around 74,000 farms, and more than 60% of famers in some regions have been under the EFP program. This suggests a positive assessment of program performance based on the program uptake information. In-depth analysis on farmers' participation in the EFP programs are summarized based on the two case studies of Ontario and Nova Scotia. The study by Robinson (2006) states that farmers participating in the Ontario EEP have put their emphasis on the bottom-

up approach employed by the EEP with farmers as the main driver determining and planning environmental issues on farms. In addition, the farmer-led environmental action of the EFP has proved its success through the adoption of EFP by regional governments across the country. However, environmental benefits derived from the EFP are difficult to obtain (Robinson, 2006). The study of Nava Scotia EFP's farmer participation by Yiridoe et al. (2010) shows that attending program-specific workshops and information sessions, and farm stewardship demonstrations enhances the program participation. In addition, the study also indicates that conventional sources of information on conservation farming (such as newsletters, magazines, and farm demonstrations & tours) are most preferred. Obtaining such information through peer farmers and government agencies are also highly ranked in importance. Hence, even though provision of information on conservation farming can be obtained through various sources (such as online information provision), conventional sources and channels are still considered important and enhancing the program participation. In addition, the study of Yiridoe et al. (2010) also shows that large farm size, high farm income, and livestock farming are significant factors of participation in the program. Social pressure is also considered a driving force for program participation. The studies of Robinson (2006) and Yiridoe et al. (2011) indicate common cases where livestock farmers participated in the program because of local community's concerns about pollution generated by livestock farming.

Incentive payment for Beneficial Management Practices (BMPs) has been implemented all over the country to address agri-environmental issues. Based on two studies, the study on "Best Management Practices to Enhance Water Quality by Ghazalian et al. (2009), and the study on "Beneficial Management Practice Adoption in Five Southern Ontario Watersheds by Filson et al. (2009), factors determining farmers' participation in the BMPs programs are summarized in this report. To address water quality in the Chaudie`re watershed in Quebec, BMPs (including crop rotation, surface runoff control, control of herbicide use, and solid and liquid manure control practices) are promoted to intensive crop and livestock farmers for adoption. The study of Ghazalian et al. (2009) states that large farm size, high education, being a female famer, being an older producer, living on-farm, and participation in watershed-based conservation group club were factors that had a positive impact on adoption of BMPs. The study of Filson et al. (2009) also provides similar results suggesting that farm size does determine the BMPs adoption. In addition, based on the adoption rate constructed under this study, the adoption of BMPs among livestock farmers is higher than that of other farming types, such as crop production. Environmental responsibility is mentioned as the first reason for participating in the BMP program, followed by provision of financial incentive, economic benefits, and environmental regulatory requirement (Filson et al., 2009).

- Agri-environmental Group Planning (AEGP) in Saskatchewan, Canada

Under the AEGP, environmental risk assessment and group action plan are determined by the farmers' group under support from both government and non-government organizations. Based on the group risk assessment and action plan, an individual farm plan is developed to apply for support in BMPs implementation. From 28 initiated AEGP programs, approximately ten projects have been in place since the initiative began in 2005 (OECD, 2013b). According to OECD (2013b), a combination of internal and external factors contributes to the

success of AEGP programs. Internal factors, such as farmers' attitude and concern about the environment, have played an important role determining farmers' involvement in the AEGP programs. Financial support as an external factor generally incentivizes farmers' participation and adoption of eco-friendly practices. In addition, sharing of common interest in addressing environmental issues within a geographical-ecological boundary enhances collective action. Roles of non-government organization in facilitating the program and providing technical assistance have also contributed significantly to the AEGP programs' success. Flexibility in adopting suitable BMPs has also contributed to effective implementation and successful collective action in addressing agri-environmental issues under the AEGP programs (OECD, 2013b).

It can be concluded that in the US and Canada, various types of agri-environmental policy measures have been implemented – ranging from incentive payment-based and market-based measures to cross-compliance measures and regulatory requirements – to promote provision of public goods and services derived from environmentally friendly agriculture practices. Socioeconomic characteristics, environmental attitudes and concerns of farmers, and farm physical and financial attributes are factors determining farmers' participation in the agri-environmental programs. Financial incentives are a crucial factor for successful implementation of agri-environmental incentive-based policy measures in these two countries. In addition, complementary supports from both government and non-government organization in the form of technical support and information provision contribute to the success of agri-environmental policy implementation.

Chapter 6

Experiences from Australia and New Zealand

This chapter reviews policies supporting “Multifunctional Agriculture” implemented in Australia and New Zealand. The chapter consists of two main parts: the first part examines experiences from Australia and the second discusses experiences from New Zealand. For each case, a general description of the agricultural sector and its performance is provided, followed by a review of major agri-environmental issues addressed in the respective country. A range of implemented policy measures is described, followed by an assessment of selected agri-environmental programs.

6.1 Experiences from Australia

6.1.1 Performance of agricultural sector and agri-environmental issues

Agriculture is the main economic activity in Australia accounting for more than 50% of the total land area of 760 million hectares, and currently contributing around 3-4 % to GDP Australia also is one of the major exporters of agricultural products in the world. More than 60% of the country production is for export ranging from wool products, beef, sugar, wheat, sheep meat, wine and dairy products (OECD, 2008a and 2015). Australia has faced various environmental issues associated with agricultural activities. Issues regarding soil and water resources are the most crucial and have been tackled by the Australian government for several decades.

- Water Resources

With regard to water resource issues, agricultural activities have contributed to the degradation of water resource quality due to nutrient leaching and sedimentation in various rivers, waterways, and coastal resources. The most alarming case gaining attention in not only Australia, but the world is the continuous degradation of the “Great Barrier Reef” in Queensland, one the most famous world heritage sites. Nutrients discharged from farmland, particularly in the inorganic form of nitrogen, have posed the greatest ecological effect on the reefs. Agriculture is also the main consumer of water resources. More than 60% of surface water resources is consumed by the agricultural sector for irrigation of crops and pastures. Water scarcity is one of the agri-environmental issues that have been given highest priority by the Australian government. Even though water scarcity is not a nationwide concern, it is found to be a serious problem in certain areas with a high density of large-scale intensive irrigated farms. In the Murray-Darling Basin, for instance, withdrawal of surface water resources has been at an unsustainable rate due to the continuously growing demand of water for irrigation. Groundwater resources, an important additional source of water supply, are also under threat due to excessive extraction in many areas (Pannell and Roberts, 2015; DSEWPaC, 2011).

- Land Resources

Without irrigation, Australia possesses only a small fraction of arable land, accounting for just 6% of the nation’s total land area. Most parts are naturally characterized as high in salt content and acidity-prone, with low nutrient levels and shallow soil depth. Clearing land for agriculture, intensive use of surface irrigation and excessive

extraction of groundwater have induced soil salinization, acidification and erosion in various areas. It is reported that around 5% or at least 2.5 million hectares of arable land is subject to dryland salinization, and more than 10% of irrigated area or about 2.3 million hectares is classified as salt-affected area. With the same affecting rate, it is forecasted that around 615,000 hectares will be under potential serious effects over the next 20 years (Water for Life, accessed 26/01/2016). Soil acidification occurs on about half of the country's productive area. Intensive farming practice, using nitrogen fertilizer in particular, has proved to be the main cause of this problem. Severe climate conditions, expressed in long periods of drought and strong rainfall events, are the strongest determinants of soil erosion in Australia. This problem has been further accelerated by unsustainable agricultural practices. It is reported that in the areas of the North and Central Plateaus, severe erosion has been caused by land clearing for grazing and other agricultural purposes (Pannell and Roberts, 2015; DSEWPaC, 2011).

- Biodiversity

Australia is considered as one of the world's biodiversity hotspots with high diversity of both flora and fauna. However, in the past decades, losses of biodiversity have become one of the nation's main concerns. Continuous land clearing for agriculture in general and grazing in particular has severe implications on biodiversity through habitat fragmentation in many areas, such as the Murray-Darling Basin. A highly fragmented nature of vegetation systems is found across eastern and western part of the country where the threatened species are also recorded (DSEWPaC, 2011). As mentioned earlier, pollution discharged from agriculture activities has also contributed to the degradation of coastal or aquatic biodiversity, such as recorded for the case of "Great Barrier Reef" (Pannell and Roberts, 2015).

- Greenhouse gas emissions

Even though the agricultural sector contributes only about 15% of overall greenhouse gas emission, it is the main emitter of methane (CH_4) and nitrous oxide (N_xO) accounting for more than 50-70% of the nation's total emission of these two greenhouse gases in 2009 (State of the Environment 2011 Committee, 2011). Methane emissions are mainly caused by livestock rearing and rice cultivation, while emissions of nitrous oxide are from cropping activities, including application of nitrogen fertilizer and the burning of savannas and crop stubble residues (Pannell and Roberts, 2015; DSEWPaC, 2011).

6.1.2 Agri-environmental policy measures

Various Australian governments have put their emphasis on agri-environmental issues under a number of programs. One of the major federal programs addressing environmental issues related to agriculture was established under the so-called "National Landcare Program" implemented from 1986-1996. This program was later replaced by the "National Heritage Trust" which ended in 2008. This was then replaced by the "Caring for our Country Program" implemented from 2008-2014. At present, all previous programs are merged under a newly announced program, the so-called "The National Landcare Program". Detailed information on the evolution of the National Landcare Program is provided by the Commonwealth of Australia (2015). Under this program, various forms of support are provided to address environmental and sustainable agriculture issues.

The four main strategic outcomes expected under this program are (National Landcare Programme, accessed 01/04/2016):

1) the maintenance and improve ecosystem services through sustainable management of local and regional landscapes;

2) an increase in the number of farmers and fishers that are willing to adopt various practices to improve the quality of natural resources, and an expansion of the area of land on which those practices are applied;

3) a more active engagement and participation of local communities, including Landcare, farmers and Indigenous people, in issues pertaining to sustainable natural resource management;

4) an increase in the restoration and rehabilitation of the natural environment, including the protection and conservation of nationally and internationally significant species along with ecosystems, ecological communities, places and values.

The various policy measures addressing environmental issues related to agriculture range from incentive-based measures, regulatory requirements and community-based measures to technical and knowledge assistances. These measures that have been implemented along the evolution of the national program are outlined in the following subsections.

- Incentive payment: payments for farm fixed asset

The so-called On-Farm Irrigation Efficiency Program is an example of direct payment to farmers based on fixed assets. This program provides funds for participating farmers to improve the efficiency and productivity of on-farm irrigation systems. The program aims at providing water saving to the environment in Murray-Darling Basin (Department of Environment, accessed 01/04/2016)

- Price-based measures: Tender or reverse auction

Tender or reverse auction has been implemented successfully in many states of Australia. Tender or reverse auction is a mechanism to provide monetary incentives to farmers to move toward eco-friendly practices in order to deliver agri-environmental public benefits. Examples of tender programs implemented in Australia are;

○ The New South Wales Environmental Services Scheme

This tender scheme offered a fund for farmers via a bidding system for adopting particular land use changes identified by the government, such as establishing saltbush, perennial pastures, regenerating native vegetation or constructing systems to control run-off and drainage. Such changes were expected to provide various environmental services including soil and water quality improvement, climate benefit from carbon sequestration (Cutbush, 2006; Grieve and Uebel, 2003;).

○ The Land Management Tender

The tender program covered 1.2 million hectare of Liverpool plains in New South Wales. The approach has been to auction contracts to landholders on land use management offering environmental benefits such as

biodiversity conservation, improvement in water quality improvement, and reducing risk of dryland salinity (Cutbush, 2006).

- Reef Trust Tender

To tackle the water pollution problem discharged to the Great Barrier Reef, this program provided financial incentives to sugarcane farmers to improve their nitrogen and irrigation management practices. The principle of reverse auction is applied in this on-going Reef Trust Tender program in two areas, Wet Topics and Burdekin, where excessive nitrogen use in sugarcane farming discharged into the Great Barrier Reef affect the water quality (Department of Environment, accessed 01/04/2016; Brodie et al., 2012).

- Market creation: water market

A water market system was established in response to the over-extraction of water resources for irrigation in the Murray-Darling Basin. In 1997, a cap on water extractions was set as a restriction on maximum allowance of water extraction for irrigation applied to tackle water scarcity in the area of Murray-Darling Basin, the largest irrigation zone. Water rights were defined based on the maximum allowance of water extraction, and the farmers entitled as rights holders were allowed to trade their rights (Pannell and Roberts, 2015). For the purpose of restoring the environmental balance of the Murray-Darling Basin, buying-back of water rights was implemented by the Federal Government (Department of Environment, accessed 01/04/2016).

- Market creation: Carbon credit trading

The Emission Reduction Fund, built on the Carbon Farming Initiatives (CFI) enacted in 2011, is a voluntary offsets scheme and aims at providing incentives to farmers and landholders to reduce carbon emissions or sequester carbon in soils or plants. The primary objective of the Emissions Reduction Fund is to curb GHG emissions in a most cost-effective way, thereby contributing towards Australia's relatively modest target of reducing emissions by 5% below the 2000 levels by the year 2020. The scheme includes several farm activities, such as reducing emissions from animal husbandry, increasing the efficiency of fertilizer use, enhancing the sequestration of carbon in agricultural soil, as well as storing carbon through rehabilitation of vegetation and reforestation. Benefits offered to famers or landholders are carbon credits which can be traded in the carbon market for emission offsets or sold back to the government as a source of income (Department of Agriculture and Water Resource, reviewed 10/02/2016).

- Community-based mechanisms

The Landcare movement has been pioneered in Australia and later replicated in New Zealand. It is a unique partnership between federal and state governments, local communities and the business sector to address agri-environmental challenges at the watershed and landscape level. The Australian government established Landcare Australia Limited (LAL) as a private non-profit company. The aim of LAL has been to encourage community groups to develop stronger capacities in self-governing natural resources and foster their capacity in adopting sustainable land and water management practices (OECD, 2013b).

- Regulatory requirements

In general, regulatory requirements for sustainable land use are commonly used obliging landowners/farmers to comply with. Such requirements include restrictions on resource use, strict rules on agro-chemical use, and requirement for soil/water conservation. Strict rules concerning the storage and application of chemical fertilisers and pesticides are imposed. For example, Australia prohibits the aerial spraying of pesticides. Applying buffer strips around water courses and groundwater sources is required in order to limit nutrient leaching (Pannell and Roberts, 2015; Vojtech, 2010).

Apart from all measures mentioned above, a significant amount of financial expenditure for agri-environmental programmes is spent to finance technical assistance of farms related to the implementation of the practices required by the various programmes (Vojtech, 2010).

6.1.3 Assessment of agri-environmental programs

- Conservation tender in Australia

Conservation tender has been applied throughout the country to deliver agri-environmental public goods in various forms such as biodiversity conservation, water quality improvement, land degradation protection, salinity control, carbon storage and landscape preservation. In Victoria, after the first BushTender Trial was commenced in 2001, a number of conservation tender programs has been implemented. During the period of 2001-2012, there were 465 landholders involved with the total land area under tender agreement accounting for 35,251 hectares. In addition, it was reported that gain accrual over contract period was 5,560 habitat hectares, while 9,688 hectares was the total area under permanent protection by covenants (Department of Environment, Land, Water and Planning (DELWP), updated 04/01/ 2016). Cost-effectiveness in achieving the government's aim of environmental conservation can be expected from implementing a tender-based approach, as seen from the BushTender Trail as a case study (Stoneham et al, 2002). The study of Blackmore and Doole (2013) provides an in-depth analysis of factors determining landowners' participation in Vitoria conservation tender programs and also on factors for program improvement. Strong relationship (with face-to-face interaction) between landholders and implementing agencies is considered the most important factor encouraging program participation, followed by low administrative cost related to paperwork required by the program. Landholders' altruistic attitude and concern on environment are also positive determinants of program participation. With regard to issues for future improvement of the tender program, duration of contract at approximately 5-10 years was the most preferred among the interviewed landholders participating in the program to deliver meaningful biodiversity conservation outcome compared to less than 5-year and more than 5-year contracts. Improvement in provision of information workshops, the program entry process, and bid selection are the landholders' concern. In addition, improvements in the monitoring system, such as frequent site visits by the program officers, could enhance program participation in the future (Blackmore and Doole, 2013).

- Cap-trade water rights in the Murray-Darling Basin, Australia

Introduced in 1997, cap-trade water rights in the Murray-Darling river basin aim at solving over-extraction of surface water resource and maintaining the basin's river system. Water resources are extracted to serve various

purposes, among them water for irrigation which is considered a main consumptive use of surface water in the basin. Under the trading system, a cap on maximum allowance of surface water diversion is set, and water rights are distributed and traded among users in the basin. Apart from farmers and other water users, the government also plays the role of buying water rights under the trading scheme. Water rights consist of entitlement and allocation rights which can be traded in the market. Details of water rights are provided by the Bureau of Meteorology (Bureau of Meteorology, accessed 01/04/2016). With regard to trading performance, both entitlement and allocation sales have shown upward trends during the period of 1999-2009 (Grafton and Horne, 2014; National Water Commission, 2010). This suggests a positive assessment based on program performance. Buying back permits by the government demonstrates an achievement of cost-effectiveness in water resource management and environmental conservation outcomes. Efficiency in allocation of scarce water resources, and flexibility in water uses are provided under the trading system (Grafton and Horne, 2014; Grafton et al., 2010; National Water Commission, 2010). In addition, a positive environmental impact of the trading scheme was observed in the form of increases in end-of-system flows in some waterways derived from trading during the period of 1998/9 to 2007/8. Consequently, the flow supported ecological conditions in the waterways during the millennium drought (Grafton and Herne, 2014; National Water Commission, 2010). Restrictions on trade are seen as major barriers of trading. However, as some restrictions have been cancelled, trading performance is expected to improve (Grafton and Horne, 2014).

- Landcare in Australia

Since 1989, Landcare has been implemented all over the country under the community-based approach in delivering sustainable agriculture and environmental management. Factors determining success and barriers of the Landcare programs summarized in this report are based on the studies of Tennent and Lockie (2013), and OECD (2013b). In general, stakeholders involved in the community-based Landcare programs include community members of both farmer and non-famers taking major roles in grogram implementation, while the government involves as supporting agent with the provision of financial, technical, scientific knowledge and administration supports (OECD, 2013b). Based on two case studies provided by OECD (2013b), a successful implementation of the landcare programs are largely relied on local leadership with strong commitment to facilitate collective action, together with community's understanding and willingness in pursuing program objectives. In addition, long-term membership of the community members helps to secure stability and continuity of program implementation (OECD, 2013b). The study by Tennent and Lockies (2013) raises important factors potentially jeopardizing sustainability of the Landcare programs. As important the leadership (as mentioned earlier) is in contributing to the success of Landcare programs, lack of long-term commitment and experienced community leadership and declining of community memberships are challenging the sustainability of the Landcare programs in the future. Shifting in government funding policy and increasing compliance costs due to rigid requirements of funding support are considered factors discouraging the continuation of the community-based Landcare program in agriculture and natural resource management in Australia (Tennent and Lockie, 2013).

6.2 Experiences from New Zealand

6.2.1 Performance of the agricultural sector and agri-environmental issues

Pasture and arable land of New Zealand cover more than half of the total land area of 268,000 square kilometres. The contribution of the agricultural sector to real GDP is around 4%. With the inclusion of food processing, beverage and tobacco products, the primary sector accounts for 7.5% of real GDP contributing to more than half of the export value. Dairy and other livestock farming are the major activities of New Zealand's agricultural sector, followed by horticulture such kiwifruit and apple farming and viticulture (The Treasury, 2015).

Enjoying substantial benefits provided by its agricultural sector, the country also has faced serious negative effects stemming from agricultural activities posing serious threats onto the environment and society as a whole. Among various agri-environmental issues, greenhouse gas emission and water resource degradation are serious issues requiring effective measures to tackle.

- Water resource degradation

About 90% of New Zealand's lowland rivers have been affected by pollution from farming activities, mostly from animal effluents in the form of urine and fertiliser leaching into soil and water resources, according to figures from the National Institute of Water and Atmospheric Research (Greenpeace New Zealand, 2009). From 1990-2012, nitrogen leaching increased by 29%, primarily as a result of increasing numbers of dairy cattle and excessive fertiliser use. The process of excess nitrogen seeping into soil and rock layers and traveling on to groundwater resources, lakes and rivers stimulates algae growth, thereby reducing oxygen levels, impeding river flows and altering the riverbed and its fauna. This process negatively affects fish populations who depend on aquatic plants for feed (Ministry for the Environment, reviewed 29/07/2013).

- Greenhouse Gas Emission

Agriculture is responsible for almost 50% of New Zealand's domestic greenhouse gas emissions. Dairy and livestock farms are the main emitters of GHG including nitrous oxide gas from animal waste, manure, and fertilizer, and methane as a by-product of feed fermentation in ruminant's digestive systems. Emission of nitrous oxide gas stems mostly from animal waste (such as urine), cow manure composting, and application of nitrogen-based fertilizer. Since 2009 New Zealand's GHG emissions from agriculture have increased by 15%, primarily due to the expansion of the dairy sector. The number of dairy cows in the country has risen by 58% from 1990-2007 (Greenpeace New Zealand, 2009).

6.2.2 Agri-environmental policy measures

Policy measures addressing environmental issues related to agriculture implemented in New Zealand are based on the Resource Management Act 1991 (RMC) and the Sustainable Farming Fund (SFF). The Resource Management Act, enacted in 1991 and reformed in 2013, is the national regulatory framework to promote sustainable natural resource and management pursuing the 'Green Growth' agenda of the country. In 2010, the Environmental Protection Authority (EPA) was established with the main responsibility in policy implementation (Bibbee, 2011). The SFF aims at supporting both community and producers in the primary

sector to improve both productivity and environmental performance. With particular respect to agri-environmental public goods issues, various policy measures – ranging from market-based to command-and-control to community based measures together with technical supports as complementary measures – have been developed based on RMC and SFF.

- Market creation: Emissions Trading Scheme (ETS)

Emission Trading Scheme (ETS) developed under the Climate Change Response Act 2002 has been New Zealand's important policy measure that aimed at reducing greenhouse gas (GHG) emissions in order to meet the Kyoto Protocol's obligation. With this trading scheme, the price of carbon is considered as an incentive for emitters to reduce their carbon emissions. In case of the agricultural sector which is one of the main GHG emitters, more efficient farm management in various aspects such as use of nitrogen fertilizer, animal waste abatement, and planting trees as carbon storage are encouraged as means for farmers to reduce their carbon emission (Bibbee, 2011). Full inclusion of the agricultural sector into the ETS was expected since January 2013, but has been postponed up to now due to strong resistance from the farming lobby (New Zealand Herald, 24 November 2015). Although the agricultural sector has not been integrated into the ETS, mandatory reporting of emissions has been imposed since 2012 (Ministry for Primary Industries, update 10/12/2015).

- Market creation: Lake Taupo Nitrogen Trading

To tackle the serious problem of water resource degradation in the Lake Taupo, the largest lake and one of the main tourist attractions in the North Island of New Zealand, nitrogen permit trading as market-based measure is implemented by the Waikato Regional Council. Nitrogen discharged from livestock and dairy farms is one of the main causes of water resource degradation in the lake. To Determination of maximum nitrogen discharge Nitrogen permits, issued based on the determination of maximum nitrogen discharged allowance, are allocated among farmers in Taupo catchment. Permit holders are allowed to trade their permits. Cost-effectiveness in reducing the nitrogen discharged and improvement in water resource quality are the expected outcomes from this trading scheme. In addition, the trading scheme is also expected to provide incentives for farmers to move toward more eco-friendly farming practices (Bibbee, 2011; Duhon et al., 2011).

- Economic incentives: payments for planting tree as carbon storage

Under the forestry component of the ETS, financial incentives are provided for tree planting as carbon storage on farmland. In addition, incentives for permanent tree planting are offered by the Permanent Forest Sink Initiative and the Afforestation Grant Scheme under the Ministry for Primary Industries (Ministry for Primary Industries, updated 23/03/2016).

- Command-and-control: regulatory requirements

Regulatory requirements are widely applied to address agri-environmental issues in New Zealand. A range of environmental standards and requirements for resource uses are derived under the national legislation framework, Resource Management Act (1991). Regional councils take responsibility in the implementation and enforcement of these regulatory requirements. In order to ensure the water quality, effluent standards of waste

water discharged from dairy farms are set with the limit of annual nitrogen discharge at 150-200 kilogram per hectare. To limit nutrient leaching into natural water sources, the application of water resource conservation using buffer strips is a common requirement. Even though New Zealand is considered a country that is rich in water resources, there is a significant regional variation in the distribution of supply and demand. To avoid over-extraction of water resources for irrigation in some areas such as in Canterbury and Otago, “resource consent” is applied for water resource allocation and management. Regulatory requirements attached to the consent such as duration of consent, maximum allowance of resource extraction, also vary reflecting situations in each region (Bibbee, 2011; Ministry for the Environment, reviewed 01/12/2010; Vojtech, 2010)

- Community-based mechanisms

New Zealand is one of a few OECD countries that put strong emphasis on community-based mechanisms to address agri-environmental issues. A number of farmer groups registered under the Landcare Trust operated by the Ministry for the Environment have received both monetary and non-monetary support for community-led projects pursuing sustainable agriculture and environmental management from the Community Environmental Fund. This fund superseded the Sustainable Environmental fund launched in 1994, for the past decades. In addition, the Sustainable Farming Fund launched in 2000 under the Ministry for Primary Industries has offered support for applied research and extension projects on issues of financial, environmental and social performance of farming and forestry. One important aspect of this fund is to encourage information, technology and knowledge to be transferred to end users, farmers and communities in particular. Community irrigation schemes under the Ministry for Primary Industries provide financial support to community-irrigation development and also upgrade existing irrigation infrastructure system to achieve sustainable use and management of water resources (Ministry for Primary Industries, reviewed 29/01/2016; Ministry of the Environment, reviewed 18/03/2015; OECD, 2013b).

- Complementary measures

Complementary measures refer mainly to support in the form of research & development (R&D) provided by the government to address agri-environmental issues. In response to rising greenhouse gas emissions from agriculture sector, research and development in the field of emission mitigation is a national priority. The New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) was established in 2010 under the government fund. The main purpose is to be a centre for research and development on agriculture greenhouse gas emission mitigation. With particular interest in the pastoral sector, a private-government partnership established the Pastoral Greenhouse Gas Research Consortium (PGGRC) in 2002. This consortium aims at providing livestock farmers with knowledge and economically viable mitigation practices while maintaining farming productivity (Ministry for Primary Industries, updated 10/12/2015; Bibbee, 2011).

6.2.3 Assessment of agri-environmental programs

- The Lake Taupo Nitrogen Cap and Trade Programme in Waikato Region, New Zealand

Fully implemented in 2011, the Lake Taupo nitrogen trading scheme aims at restoring water quality of the lake by reducing nutrient (particularly nitrogen) leaching from agriculture. Detailed information of this trading scheme

is provided by Duhon et al. (2015). A cap on maximum nitrogen allowance derived from the goal of 20% nitrogen reduction by 2020 (153 tonnes annually) is used as a basis for identifying available permits to be traded and a grandfathering system is applied for initial permit allocation. Based on the tradable permit mechanism, permit sellers are farmers who are able to convert to farming practices that achieve nitrogen reduction at a cost less than the market price of the permit. Farmers decide to buy additional permits as their net profits from practicing nitrogen-intensive activities (such as dairy farming) exceed the market price of the permits. One special aspect of this trading scheme is that apart from farmers as emitters involved in the trading system, the Lake Taupo Trust set up in 2003 plays an important role in trading to ensure the achievement of 20% nitrogen reduction under the public financial support of NZD 81.3 million (USD 57 million) from the national government (45%) and 55% from local government (OECD, 2012). Summarizing from Duhon et al. (2015), three main aspects for program evaluation include (1) scheme performance, (2) socio-economic impacts, and (3) issues of improvement are provided as follows;

Scheme performance: Since the first trade in June 1999 to June 2012, accumulative trading under the program has shown an upward trend with the total trading transaction of 32 trades. However, the total permit trading accounts for only around 17% of the total permit allowance. With respect to the trading pattern, more than 50% (or about 19 trades) of the total trading transaction is considered “public trading” where the Lake Taupo Trust retries the permits permanently in order to reduce the nitrogen loading. This is seen as evidence of cost-effectiveness in achieving the target of nitrogen reduction. 30% of trading occurs between private permit holders, so-called “private trading”, suggesting efficient allocation of nitrogen emission allowances to the most profitable uses. The rest of the trading activities is short-term leasing whose flexibility in adjusting nitrogen reduction performance is offered through the trading system (Duhon et al., 2015). In sum, cost-effectiveness in achieving nitrogen reduction, efficiency in allocation of nitrogen reduction permits, and flexibility in nitrogen reduction performance can be observed under the Lake Taupo trading scheme suggesting a positive assessment regarding the program performance.

Socio-economic impacts: With respect to economic impacts caused by the trading scheme, decrease in farmland value is considered as a result of limitations in production intensification derived from being under the cap. In addition, changes from farming to tree planting (due to the emphasis on reduced nitrogen emission practices) and out-migration of some farmers from the catchment have posed negative impact to farming community from the social point of views (Duhon et al. 2015).

Issues of improvement: The major challenge of this trading scheme is to identify a benchmark of nitrogen emission across all involved emitters and monitoring for compliance. As emission of nitrogen cannot be observed easily, the scheme employs a nutrient budgeting tool to identified nitrogen leaching based on data of farming practices and type of farms. In addition, transaction costs involved along the process of trading scheme is considered an issue that needs to be improved in the future. Enhancing information provision and accessibility is considered an aspect for reducing transaction costs incurred along the trading process (Duhon et al., 2015).

- Sustainable Farming Fund in New Zealand

Introduced in 2000, the Sustainable Farming Fund (SFF) aims at promoting collective action in addressing agri-environmental issues. The case of the Aorere Catchment Project is used as a representative for an assessment of the SFF. The Aorere Catchment Project was implemented during the period of 2007-2009 with the main purpose of improving water quality in natural waterways, Golden Bay in particular. Dairy farming is predominant in the catchment accounting for 16% with the total number of around 30 farms. Fecal bacteria runoff from dairy farming is considered the main cause of water quality degradation which consequently imposes negative effects onto shellfish farming along the bay. Various activities including conducting impact assessment of dairy pollution runoff and developing a farm plan with best management practices were implemented under the 3-year project funding initiated by the dairy community (Robertson et al., 2014; Uetake, 2012). The project successfully achieved its objective of water quality improvement as indicated by an increase in shellfish harvesting days from 28% in 2002 to 50% in 2006, and up to 79% a year after the project finished in 2009 (Uetake, 2012). This suggests a positive assessment of this program performance. The bottom-up approach of this project initiative plays an important role addressing local issues requiring collective action within the community (Uetake, 2012). Based on the project evaluation conducted in 2010 by Robertson et al. (2014), the key to the success of this project is the shared values among involved farmers of improving quality of local waterways which leads to strong engagement in implementing best management practices to reduce pollution discharged. In addition, mutual trust and understanding derived from frequent communication among all stakeholders involved (including dairy farmers, shellfish farmers, project coordinators, and outside experts) has also been a crucial factor for successful project implementation in achieving water quality improvement in the catchment (Robertson et al., 2014).

To address agri-environmental issues, Australia and New Zealand have put their emphasis on market-based policy measures implemented in the form of conservation tender and cap-trade rights/permits at farm level, and financial support provided to promote collective action at community level. Flexibility and cost-effectiveness in achieving environmental targets are features obtained from the market-based policy measures. However, social and economic impacts and complications in setting up the trading systems are often seen as limitations in implementing the cap-trade systems. With regard to the community-based incentive programs, local leadership together with cooperation of community members, support from government and non-government organizations in the form of funding, technical assistance and information provision are factors contributing to the success of agriculture and natural resource management in Australia and New Zealand.

Chapter 7

Experience from Japan and Korea

This chapter provides a review of agri-environmental policy measures implemented in Japan and Korea. Prior to that, the performance of the agricultural sector and agri-environmental issues are briefly presented. An assessment of selected policy measures from each country is provided based on literature reviews.

7.1 Experience from Japan

7.1.1 Japan's agricultural sector and agri-environmental issues

Under the total land area of 365,000 square kilometers, only 30% is classified as arable land which is dominated by irrigated paddy fields. Japan's farming sector is characterized by small family farms with an average farm size of less than 2 hectares. Conversion of agricultural land for other economic purposes together with farmland abandonment has been observed in the past decades. The contribution of the agricultural sector to GDP is small, accounting for only around 1.8% in 2000 and further going down to 1.2% in 2013. However, agriculture in Japan is highly protected due to various reasons, such as maintaining a minimum level of food security and sustaining agricultural landscapes of high cultural significance. Even though the support has been decreased, it is still quite high compared to many other OECD countries. Japan has been one of the biggest net-importers of food in the world for many years. Agro-food imports account for 7.4% in overall imports, while less than 1% of total exports are made up by agro-food exports (OECD, 2015 and 2010). Agri-environmental issues in Japan are briefly described as follows;

- Soil and water resource degradation

The decline of the agricultural sector has contributed to lessen the negative impacts on the environment and natural resources. However, in some areas where agriculture is still dominant, negative externalities are still needed to be tackled. For crop production, the use of chemical fertilizers, nitrogen in particular, is still high, while the use of phosphorous is decreasing. The high density of livestock production, especially pigs and dairy cows, has also contributed to localized effluent loading even under the installation of wastewater treatment at sites. In sum, nitrogen and phosphorous leaching from crop production and effluent discharge from livestock farming have contributed to the degradation of soil and water resources to some extent (OECD, 2010).

- Agricultural greenhouse gas emission

Another positive impact of the decline of the agricultural sector on the environment is reflected in the decrease of agricultural greenhouse gas emissions. Emissions of methane from rice production and nitrous oxide from decrease of fertilizer use and livestock production have decreased by 225 and 17% respectively in the period from 1990-2010 (OECD, 2013a cited in Uetake, 2015).

- Agricultural landscape, biodiversity and cultural heritage conservation: *Satoyama*

Satoyama is a mix of farmland (paddy fields) and secondary forest providing various public goods to the society. Paddy fields and their irrigation systems offer services for disaster resilience by retaining water for flood protection and fire extinction. It also buffers runoff from melting snow. Moreover, *Satoyama* is also a habitat for freshwater aquatic lives. In addition, cultural heritage derived from farming activities and traditional way of life in rural community settlements is also considered as public goods with high value to the Japanese society. In the past decades, conversion of farmland for other economic non-agricultural purposes and the aging of agriculture communities has had a hugely detrimental effect on *Satoyama* (Uetake, 2015; OECD, 2010).

7.1.2 Japan's agri-environmental policy measures

- Satoyama Initiative

In an attempt to preserve *Satoyama* landscapes, the *Satoyama* Initiative was launched in 2008. The initiative has been promoted internationally at the COP 10 biodiversity meeting in Nagoya in October 2010. The Ministry of Environment (MOE) has played a leading role providing guideline for *Satoyama* conservation to local governments. The Ministry of Agriculture, Forestry and Fisheries (MAFF) has then joined the program by introducing a direct payment as an incentive to farmers for emphasizing multifunctionality of agriculture. The Ministry of Internal Affairs and Communications (MIC) also participates by providing assistance to local governments to promote rural development using "Satoyama" as eco-tourism. In some areas, citizens who benefit from landscape conservation pay a fee to farmers for their extra effort in conserving the landscape (Uetake, 2015 and 2013; Koike, 2014).

- Economic-incentives: direct payment based on farming practices

To address agri-environmental issues, incentives are provided for farmers to adopt environmentally friendly practices under a particular program, the so-called Direct Payment to Farmers in Hilly and Mountainous Areas (DPFHMA). Introduced in 2000, DPFHMA aims at reducing farmland abandonment by providing financial incentives for farmers to continue agricultural activities in hilly and mountainous areas. Rural landscape and biodiversity conservation, water resource preservation and flood and landslide prevention are public goods offered by the continuation of farming in these areas. Direct payments to farmers to adapt their farming practices in support of biodiversity conservation is implemented by some local governments. An example is the program introduced by Toyooka City (Uetake, 2015).

- Regulatory measures addressing agricultural pollution

To control pollution from farming activities, standard setting is also applied in Japan. An upper limit of effluent discharge from livestock farms is set under the Pollution Control Law. In addition, under the law concerning Appropriate Treatment and Promotion of Utilisation of Livestock Manure (ATPULM), a mandatory standard for livestock manure management was established in 1999 in order to tackle negative impact on soil, water, and air quality from livestock manure discharge. Installation of manure management facilities is required together with a provision of financial support on recycling manure facilities. To address the issue of soil degradation and

food safety, toxic substances such as cadmium, copper and arsenic are regulated under the Agricultural Land Soil Pollution Prevention Law (Uetake, 2015).

- Cross compliance

Similar to the case of the European Union, cross-compliance is also used in Japan mainly for addressing agri-environmental issues. To tackle the problem of soil and water resource degradation, under the Act for the Establishment and Extension of Agricultural Practices that Facilitate the Sustainable Development of Agriculture (SDA) introduced in 1999, “Eco-farmer” certification system was established requiring farmers to be to be certified in order to receive financial support. The financial support in form of interest-free loan is offered to farmers to invest in farm fixed assets utilized for improving farming practices targeting soil and water resource improvement. The Direct Payments for Environmentally Friendly Farming (DPEFF), launched in 2011, focuses on biodiversity conservation and climate change mitigation by providing payments to farmers to adopt various environmental conservation practices including applying cover crops, living mulches, and winter-flooded paddy fields. Being certified as “Eco-farmers” by the government is a pre-requisite to be eligible to participate in this program. To be eligible for certification as “Eco-farmers”, certain farming practices such as a 50% reduction of chemicals as compared to conventional system are required (Uetake, 2015).

- Community-based measures

Community-based measures have played quite an important role addressing agri-environmental issues in Japan. Collective action related to irrigation system management was promoted under the Measures to Conserve and Improve Land, Water, and the Environment (MCILWE), a five-year plan introduced by the Ministry of Agriculture, Forestry and Fisheries (MAFF) in 2007. Payments for activities relating to operation and maintenance of irrigation system are provided to the local action groups involving farmers and non-farmers. Various environmental public goods, such as agricultural landscape preservation, water quality improvement, and flood prevention, can be offered under the well-maintained irrigation systems. In addition, MCILWE also provides financial support for activities including reduction of chemical uses and adoption of good agricultural practices to farmer groups involved in the collective activity groups. From fiscal year 2014, the MCILWE payments for agricultural multifunctionality through collective action have expanded covering not only paddy fields and irrigation, but also agricultural activities in the uplands and pastures (Uetake, 2015; Yamada, 2011).

- Complementary measures

Complementary measures supporting the provision of agri-environmental public goods cover a wide range of activities including technical assistance, extension, R&D and certification of eco-labelling. Technical assistance and knowledge are provided to farmers under the program of “eco-farmer” certification. Under the Law on Promotion of Organic Agriculture, enacted in 2006, research and development together with extension services in organic farming have been provided by the government. In addition, raising consumer awareness on organic agriculture and establishing local plans to promote organic agriculture are also implemented under the law. In 2000, an organic certification scheme was introduced under the MAFF. Prior to that, a guideline for organic agriculture products has been provided to farmers. Eco-labelling addressing biodiversity conservation was also

promoted by MAFF in 2008. This label is applied to agriculture, as well as fishery and forestry production incorporating biodiversity conservation in their practices (Uetake, 2015).

7.1.3 Assessment of agri-environmental programs

- Direct Payment to Farmers in Hilly and Mountainous Areas in Japan

Introduced in 2000, the 5-year program of Direct Payment to Farmers in Hilly and Mountainous Areas implemented Japan aims at reducing farmland abandonment. Proper management of upland farming (such as terracing) offer public environmental services to the society in forms of flood and landslide prevention to lowland settlement in particular. Opportunity costs of maintaining farming activities are used as a basis for determining direct payments offered to farmers in the designated areas. Rate of payments vary according to characteristics of farmland, slope in particular, and types of farming including paddy fields, upland fields, and grassland (Hashiguchi, 2010; Sakuyama, 2006). According to Sakuyama (2006) positive assessment with regard to policy performance was observed with an increasing of uptake ratio (uptake areas to eligible areas) from 65% to 85% during the period of 2000-2004. Regression analysis performed by Sakuyama (2006) determined the factors that positively and negatively influenced the program uptake. The age of farmers represented an opportunity cost of participating in the program and has shown a negative effect, while farm profitability positively supports the uptake of this program. The results suggest that to effectively address less-favourable farming areas and aging factor requires differentiation of incentive payments taking into account heterogeneous farming factors. In addition, facilitation by local government plays a significant role in increasing the uptake ratio of the program. It is recommended that additional support allocated exclusively to local governments with low uptake ratio would help to enhance the program performance (Sakuyama, 2006).

- Eco-famers and Direct Payment for Environmentally-Friendly Agriculture Program in Japan

Instigated in 2011, under the five-year program of Direct Payment for Environmentally-Friendly Agriculture Program in Japan, eligible farmers are required to comply with the condition of being registered as “eco-farmers” with sustainable farming plan certified by local government and following good agricultural practices. Apart from being required to reduce chemical use by half, farmers have to adopt at least one of these practices including planting cover crops, mulching or flooding paddy in winter. Payment for practicing environmentally-friendly measures is offered to farmers on a flat rate basis irrespective of crop types. Based on information from the Ministry of Agriculture, Forestry and Fisheries, during the period of 2011-2013, three main indicators continuously increased, including area covered, entity paid, and amount of grant paid in the program (Ministry of Agriculture, Forestry and Fisheries (2007), cited in Nishizawa, 2015). This provides a positive performance-based assessment of the program. However, Nishizawa (2015) states that low budget allocated in FY 2014 as compared to other programs could lead to difficulties in progressing the program uptake. With regard to the cross compliance of “eco-farmers’” certification, an increase in number of eco-farmers has been recorded since the introduction of this certification in 1999. However, a drop of number of eco-farmers was observed from FY 2012. The reason might come from difficulties in receiving direct payments under increasing requirement for adoption of eco-friendly measures and that could discourage farmers to acquire the “eco-farmer” certificate (Nishizawa, 2015).

- Measures to Conserve and Improve Land, Water and Environment (MCILWE) in Japan

Measures to Conserve and Improve Land, Water and Environment (MCILWE) is a community-based program that has been implemented in Japan since 2007. Two schemes of payments provided under this programs include 1) payment offered to famer groups for preserving irrigation and drainage systems, and 2) payment to farmers for 50% reduction in agro-chemical use under the condition of implementing the previous type of payment. The second scheme was dissolved in 2011. Based on the information from the Ministry of Agriculture, Forestry and Fisheries, the number of action groups and acreage engaged under the first scheme have increased continuously during the period of 2007-2013, and the same pattern has been observed for the second scheme in the period of 2007-2011 (Ministry of Agriculture, Forestry and Fisheries (2007), cited in Nishizawa, 2015). This reflects a positive performance-based indicator for policy assessment of these two schemes. However, the number of action groups engaged under the second scheme accounted for only 15% of that of the first scheme, and less than 8% for the acreage engaged (Nishizawa, 2015).

7.2 Experience from Korea

7.2.1 Korea's agriculture sector and agri-environmental Issues

With a total land area of 970,000 square kilometres, only 17% has been used for farming activities. Small size of around 2 hectares under family management is the main characteristic of Korean farms. Agricultural sector contribution to GDP has declined from 6.2 to 2.3 in the period of 1995-2013. Within the agricultural sector, a decrease of the share of crop production dominated by paddy has been observed, while the share of livestock has increased from 23% to 37% in this period. However, as rice still remains the country's most important food, the production has been heavily supported by the government in order to achieve self-sufficiency level. Even though, rice policy support has decreased overtime, but it is still relatively high compared to that of other OECD countries. Like Japan, Korea is also considered as one of the biggest agro-food importers in the world (OECD, 2015).

As a consequence of the relatively small and shrinking significance of the agricultural sector, negative agri-environmental impacts have been declining. However, due to the long period of heavy chemical uses to boost agricultural productivity, soil and water resource degradation from nutrient leaching is still an important agri-environmental issue to be addressed. In addition, pollution from livestock faming in the form of ammonia emission also requires appropriate policies to effectively address this issue (OECD, 2008a).

7.2.2 Korea's agri-environmental policy measures

To address agri-environmental issues, the Environmentally Friendly Direct Payment Program (EFDPP), launched in 1990, provides incentives in the form of direct payments to farmers to switch to eco-friendly practices. Since 2002, the program has been revised and subsequently applied to the whole country. The program objectives are to promote sustainable farming practices focussing on the reduction and elimination of chemical uses and encouraging soil conservation practices in order to solve the problem of water and soil degradation, and promoting biodiversity and landscape conservation (OECD, 2012 and 2008b).

- Direct payments for environmentally-friendly farming

Under the EFDPP, direct payments for environmentally-friendly farming scheme has offered farmers financial incentives which vary according to 1) types and sizes of farming including farmlands in environmental sensitive areas (water source protection and natural park areas), paddy and upland farming, and 2) level of chemical use classified as organic, no-pesticide, and low pesticide. In 2008, 9.9% of total farmland was under environmentally-friendly farming areas (Kim and Lim, 2015).

- Direct payments for environmentally-friendly livestock farming

The EFDPP has included livestock farming into the program by launching a pilot program providing direct payments for environmentally-friendly livestock practices in 2004. The main purposes are to introduce eco-friendly manure management practices by establishing an efficient utilization system of livestock manure for crop production and also to limit stocking densities of livestock by offering farmers financial payment for their adoption. In addition, extra payment is provided for landscape conservation around farming areas (Vojtech, 2010; OECD, 2008b).

- Direct payments for landscape conservation

The Direct payment program for Rural Landscape Conservation, introduced in 2005, provided farmers a financial incentive to cultivate landscape crops in order to enhance agri-rural landscape amenity. Rice terraces are considered as the most important traditional rural landscape in Korea facing strong threat from excessive demand for land to support the fast-growing population. Various environmental services derived from rice terraces include erosion and flood control, habitat conservation, and amenity value from preserving traditional and cultural landscape of rural communities (Jung and Ryu, 2015, OECD, 2008b).

- Community measures: Agro-tourism promotion

Agro-tourism is considered as an additional source of income for famers and also contributes to rural community development. In 2002, the traditional rural theme village program was established, and communities were selected by the Rural Development Administration to promote rural tourism. Support from government was provided to selected communities for tourism planning and development of related programs. Under the green tour village programs, the government provided support to selected communities to promote rural lifestyle and agricultural farming in form of funding for facility construction and effective village tour management. In 2004, outstanding eco-villages were selected by the Ministry of Environment with the purpose of raising awareness of environmental protection and encouraging eco-tourism. From the mid-1980s, agro-tourism was pursued as another source of income for farmers (Jung and Ryu, 2015; OECD, 2008b).

- Complementary measure

Complementary measures implemented by the Korean government are to pursue the main goal in achieving eco-friendly agricultural practices, conserving agro-biodiversity and agri-cultural landscape, and offering safe food to consumers. Since 2001, product certification has been implemented. In the case of agriculture products, the three categories of environmentally-friendly agricultural product certification are organic, pesticide-free and low pesticide. The certification system includes overall product inspection for their quality and safety implemented by specialized certification agencies. In case of livestock products, certification covers product aspects including breeding, feeding, disease control, and animal welfare. Since 2005, the regional agriculture cluster programme has been implemented providing knowledge, technical and marketing assistance to farmers. Regional networks include local governments, academics, and industrial sector (OECD, 2011 and 2008b).

7.2.3 Assessment of agri-environmental program

- Environmentally Friendly Direct Payment Programme in Korea

The Environmentally Friendly Direct Payment Programme is an activity-based scheme, as incentive payments are offered according to environmentally friendly activities/practices implemented. Under this scheme, levels of environmentally farming practices including organic, no pesticide and low pesticide, determine rates of payment. In addition, flat-rate payments differ between crop types, rice and upland farming. Based on Kim and Lim (2015), policy effectiveness is reflected through the performance-based indicator of an upward trend in the number of participants and areas under the program during the period of 2008-2010. In-depth interviews with farmers show the positive perception of the program as an important aspect for long-term sustainable agriculture and environmental management of the country. However, difficulties during the transition period of moving from conventional to environmentally-farming practices raised by the participating farmers in the interviews reflect the failure to take into account the time dimension in the provision of incentive payments. Technically, 3-5 years are required for conversion from conventional to organic farming practices. This reflects directly the financial support needed during the timespan. Instead of flat-rate payments, adjustment of payment provision required along the process of conversion toward environmentally friendly farming is considered an important factor supporting farmers along the transformation period. In addition, value adjustment of incentive payments along the timespan should also be considered (OECD, 2012).

In sum, facing the problems of aging of the farming population and shrinking of the agricultural sector, both Japan and Korea have been focussing on conserving their farming sector. Direct payments have been implemented to provide financial incentive for farmers who voluntarily adopt environmentally friendly agricultural practices at both farm and community levels. Compared to other countries reviewed in this report, the implementation of agri-environmental policy measures in Japan and Korea has started later with less variety of policy instruments.

Chapter 8

Agri-environmental policy measures promoting multifunctional agriculture in Thailand

Based on the review of agri-environmental policy measure assessments of 8 selected OECD countries (provided in chapter 4-7), the chapter aims at proposing policy mixes to be introduced to promote multifunctional agriculture in Thailand. This is followed by a discussion of the institutional context required for accommodating the implementation of agri-environmental policy measures in the country.

8.1 Synthesis of agri-environmental policy measures implemented in selected OECD countries

As reviewed in chapter 2, apart from the provision of private tradable goods, “Multifunctional Agriculture” provides positive public goods and services to society in various forms, namely food safety and security, natural resource and biodiversity conservation, agricultural landscape values, rural amenities, and flood prevention. The economic, social and environmental functions provided by multifunctional agriculture can make a significant contribution to sustainable development and green growth. To encourage the shift from chemical-based, environmentally-damaging conventional agricultural practices toward multifunctional agriculture can be derived through implementation of a wide range of agri-environmental policy measures. Direct payment, price-based and market-based policy measures are rooted in an economic incentive approach that provides monetary incentives to voluntarily adopt multifunctional agriculture in both farm and community levels.

Agri-environmental policy measures have been widely implemented in the selected OECD countries, and their applications vary across the countries (as provided in chapter 4-7). Factors of success and barriers in implementation of agri-environmental policy measures are summarized based on the review of agri-environmental policy assessment provided in this report (see details in chapter 4-7) as shown in table 8.1.

Direct incentive payments have been applied to promote organic farming, agri-conservation practices, agricultural landscape and biodiversity conservation in the selected OECD countries. Direct financial payment is considered a major factor contributing to the success of the agri-environmental incentive-based policy measures. Complementary support in various forms such as provision of information, research and institutional support, and technical assistance, have played a significant role for successful policy implementation. In addition, farmers’ environmental concerns and awareness positively enhanced program participation. Compatibility of promoted agri-conservation practices with existing farming systems also has an influence on farmers’ decision to participate in the direct incentive program. Furthermore, some concerns deriving from time span in program participation require to be taken into consideration for further improvement of the direct incentive programs. Area-based flat rates commonly applied for direct incentive payment are criticized for their failure of taken into account long-term processes of conversion and maintaining organic farming in particular. In addition, the time dimension reflecting opportunity cost of land and money value adjustment need to be considered in determining the payment rates offered to farmers. With regard to characteristics of farmers, age,

education, and off-farm as main occupation positively enhance participation in biodiversity and landscape conservation program. On the other hand, small farm size, intensive farming, farming as dominant occupation are factors negatively affect adoption of best management practices. Short- and long- term financial obligations faced by agricultural farms could discourage a change from conventional farming toward agri-environmental conservation practices, in particular. Hence, additional support, for example in the form of provision of loans with low interest rate, could be considered to help motivate farmers with financial obligations to participate in the direct incentive program for multifunctional agriculture.

Under the market-based measures referring to tradable permits, cost-effectiveness in achieving environmental quality improvement, provision of flexibility and financial incentives are factors enhancing successful program implementation. However, major barriers are the system complication derived particularly from imposed rules and restrictions in the trading system. In addition, monitoring for compliance is also difficult as pollution loading from agricultural non-point sources cannot practically be observed. Consequently, negative social impacts within the farming community in the area under the trading system and devaluation of participating farmland discourage participation in the program. Conservation tender provides least cost of long-term conservation in farmland. Landholders' altruistic attitude and concern about the environment together with strong relationship between landholders and implementing agencies are crucial factors for the success of this measure. Main concerns of this measure include (1) identifying appropriate contract duration and (2) providing sufficient information on program procedure.

Incentive payments for community-based programs are based on provision of financial supports to encourage collective action in promoting sustainable agriculture and environmental management. Unlike direct payments at farm level mentioned above, the community-based measures employ the bottom-up approach in identifying agri-environmental issues to be addressed. Sharing common environmental concerns/values, understanding and willingness in pursuing agri-environmental conservation significantly contributes to successful implementation of community-based program. Local leadership with strong commitment to facilitate collective action is a crucial factor for this community-based programs. Complementary support not only from local government in providing information, technical assistance and regular visits, but also from non-government organizations in facilitating the program are necessary elements contributing to the successful program implementation. In addition, mutual trust among stakeholders derived from frequent and close communication is also important in implementing the community-based program. Derived from experiences of the selected OECD countries in implementing the community-based measures, lack of long-term commitment and experienced community leadership, decline of community memberships, shifting in government funding policy, and increasing compliance costs due to rigid requirements of funding support are the main concerns which possibly affect the success of community-based programs in addressing agri-environmental issues.

Table 8.1 Summary of factors of success and barriers of incentive policy measures implemented in selected OECD countries

Type of policy measures	Country	Factors of success	Barriers/ concerns
Direct payment for adoption of best management in agricultural conservation practices	Canada, Korea, UK, USA	- Provision of information and technical assistance - Environmental concern and awareness - Social pressure - Farmers' positive perception of the program	- Time dimension and value adjustment of financial support - Small farm size, intensive farming, farming as dominant occupation - Incompatibility of BMPs with existing farming system - High solvency or debt-to-asset ratio of farm financial performance
Direct payment for organic agriculture	Korea, Germany, UK	- Support provision through the costly and time-consuming process of organic conversion -Complementary support, such as certification costs, training and advisory costs, provision of information, research and institutional facilities	- Time dimension and value adjustment of financial support
Direct payment for biodiversity and agricultural land scape conservation	Japan, Germany, UK, USA	- Incentive payment - Age, education and the off-farm primary occupation - Farmers' environmental concern and ethical motivation - Facilitating by local government	- Increasing opportunity costs derived from positive development of agricultural commodity market - Current and debt-to-asset ratios of farm financial performance
Tradable permit for water quality improvement	Australia, New Zealand, USA	- Provision of flexibility and financial incentive - Ensuring water quality achievement from government permanently buy-back (retiring) permits	- Difficulties and uncertainty in quantifying loads from non-point sources and monitoring for compliance - Trade restriction and high transaction cost along the process of trading - Devaluation of participating land

			- Negative social impact on farming communities
Conservation tender	Australia	- Strong relationship (with face-to-face interaction) between landholders and implementing agencies - Landholders' altruistic attitude and concern on environment	- Too long duration of conservation contract (e.g. more than 10 years) - Insufficient program workshop and provision of information on bid selection, and program entry
Community based measures for sustainable agriculture and environmental management	Australia, Canada, New Zealand	- Bottom-up approach in identifying agr-environmental issues to be addressed - Local leadership with strong commitment to facilitate collective action - Community's understanding and willingness in pursuing program objectives - Sharing common environmental concern/values - Mutual trust among stakeholders derived from frequent close communication - NGOs as facilitators	- Lack of long-term committed and experienced community leadership - Declining of community memberships - Shifting in government funding policy - Increasing compliance costs due to rigid requirements of funding support

Source: compiled from various sources cited in section on "Assessment of agri-environmental programs" of chapter 4-7

8.2 Proposed agri-environmental policy measures to promote multifunctional agriculture in Thailand

Apart from reviewing the available literature and policy documents, this study sought experts' opinions on the proposed direct incentive payment measures and institutional arrangement to promote multifunctional agriculture in Thailand. This was done by face-to-face interviewing (via skype) of and by sending requests to respond to a question list (via e-mail) to academics in the field of agricultural and resource economics, and government officers under the Ministry of Agriculture and Cooperatives. The comments from a total of 17 respondents comprising seven academics and ten officers are summarized in Table 8.2. While most experts agreed with the principle of providing more incentive-based mechanisms to support multifunctional agriculture in Thailand, there was some skepticism regarding the extent to which it will be possible to substantially reduce the use of agro-chemicals, as Thai agriculture relies heavily on them. Nevertheless, I believe that it would be beneficial for farmers, consumers and the environment if the amount of chemical use in Thai agriculture would be significantly reduced and that this will only be possible if substantial monetary incentives are provided.

Interviewed Thai experts also disagreed with providing direct cash payments for farmers who implement soil and water conservation measures on their farms, as the benefits from such measures supposedly accrue directly to them. However, my point of view is that soil and water conservation measures have much wider benefits in the form of public goods and services, such as reduction of landslides and flood events, water quality, and long-term impacts on national food security.

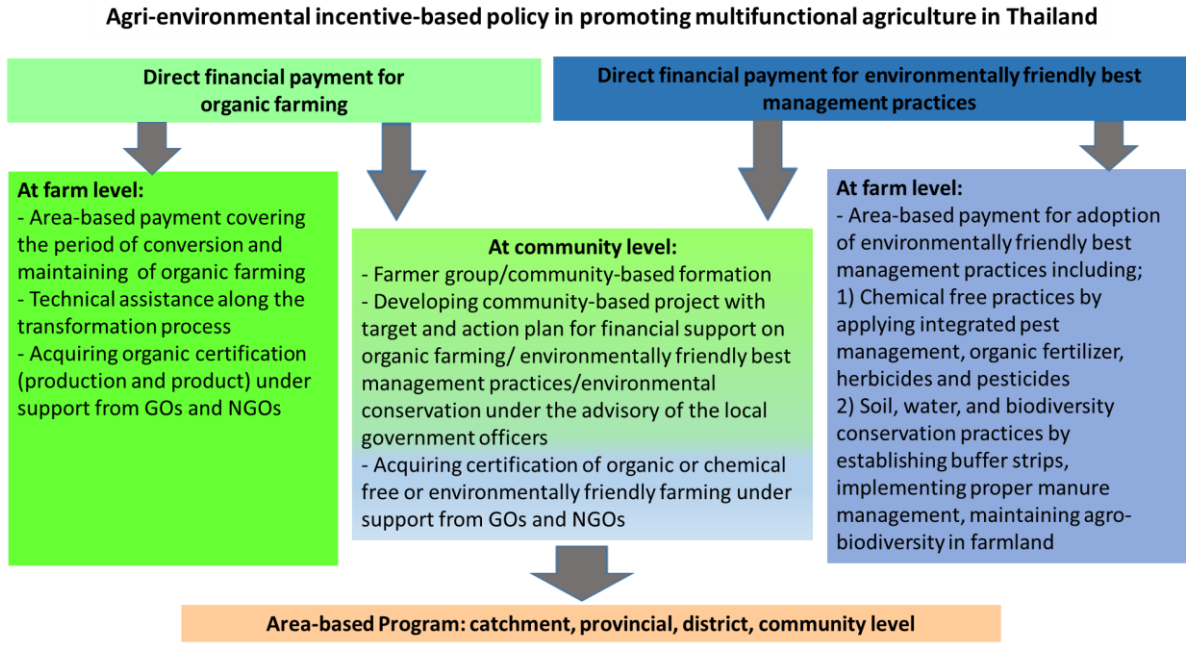
Table 8.2 Experts' opinions on "Direct incentive payment policy measures in promoting multifunctional agriculture"

Comments on direct incentive payment policy measures	**Academics**	**Government officers from MOAC**
Introducing incentive payment policy for multifunctional agriculture in Thailand	**Agree** as the incentive-based policy approach would promote agriculture along with environmental conservation which would bring benefits the whole society.	**Agree** as the incentive-based policy approach would promote agriculture along with environmental conservation which is beneficial for the whole society.
Types of direct financial incentive measures that could be promoted		
Direct incentive payment for reduction/ elimination of chemical use in farming activities	**Agree** with some recommendations on providing suitable alternatives to substitute chemicals. **Disagree** as Thai agriculture relies heavily on chemicals, hence to eliminate sounds impossible and requires substantial amount of budget and time to deal with.	**Agree** with some recommendation on providing technical assistance and knowledge on non-chemical uses. **Disagree** with the suggestion on promoting "appropriate use of chemicals"
Direct payment for soil and water resource conservation - buffer strips - cover crops	**Agree** with some recommendations on area-based application **Disagree** as major benefits from soil conservation accrued to famers. Existing in-kind assistance should be enhanced.	**Agree** with some recommendations on 1) area-based application with main focus on environmental sensitive areas, 2) alternative conservation practices contributing tangible benefits to farm household, 3) alternative conservation practices which are easy to maintain and can be applied in non-productive farm areas.

		Disagree as there are existing in-kind support schemes to promote soil and water conservation.
Direct payment for agro-biodiversity conservation in farmland using biodiversity indicators	**Agree** in principle, but unsure about monitoring process based on biodiversity indicators	**Agree** in principle, but unsure about process of monitoring based on biodiversity indicators
Direct payment for organic farming - flat rate - different rates for conversion and maintaining periods	**Agree** with higher rate for conversion period, followed by lower rate for maintaining period. Complementary support schemes, such as technical assistance, facilitating and assisting along the process of acquiring organic certification.	**Agree** with higher rate for conversion period, followed by lower rate for maintain period as this reflects the reality of conversion from conventional to organic farming. Duration of support should vary according to crop types.
Financial support for community/group-based agri-conservation project (3-5 years)	**Agree** with recommendation on establishing a pilot area-based project for organic and/or agri-conservation practices	**Agree** with recommendation on establishing a pilot area-based project for organic and/or agri-conservation practices
Direct financial incentive policy implementation and monitoring		
Responsible organization for incentive-based agri-environmental policies	Establishment of a new department under the MOAC	Establishment of a new department under the MOAC
Local governmental offices in charge of implementation and monitoring	**Agree** on implementation by local agriculture officers (regional, provincial and district levels), but recommend to have a third-party organization for monitoring such as academics from universities located in regional or provincial areas of policy implementation.	**Agree** on implementation by local agriculture officers (regional, provincial and district levels), but recommend to have a third-party organization or a committee consisting of GOs (under MOAE), NGOs, social enterprises, public representatives for monitoring

Based on the synthesis of agri-policy measure assessment and experts' comments, the three major policy measures that could possibly be introduced to promote multifunctional agriculture at the farm level in Thailand are 1) direct payment at farm level for organic farming, 2) direct payment at farm level for environmentally friendly best management practices, and 3) financial support for community-based programs in promoting multifunctional agriculture (such as organic farming, environmentally friendly best management practices, and agro-tourism). The policy mix proposed in this report is depicted in Figure 8.1.

Figure 8.1 Policy mix based on direct incentive payment to promote multifunctional agriculture in Thailand



8.2.1 Direct payment for organic farming

Organic farming has been promoted by the Thai government for more than a decade with a provision of various types of in-kind support focusing on providing organic inputs and technical assistance along with the organic certification services. However, direct financial payment has not been introduced to promote organic agriculture in Thailand. Justification of financial payment for conversion to organic agriculture is due to the fact that famers have to bear various costs incurred, not only costs related to change in production system, but also benefits forgone particularly during the transitional period from conversion to organic farming. The four main aspects enhancing the successful implementation of direct payment for organic farming are as follows:

- **Types of direct payment**: Based on experiences in Korea, Germany, and UK, area-based payment is applied and the payments are differentiated based on crop types. Payment rate is crucial as it is the major factor incentivizing farmers' adoption. Taken into account the costs incurred to farmers from conversion to organic agriculture, area-based payments are offered not only during the conversion period, but also for maintain the farmland under organic agriculture.
- **Duration of support**: Conversion from conventional to organic agriculture require certain time span. Hence, to ensure the successful implementation of direct payment for organic farming, long-term commitment for provision of payment support certainly enhances farmers' participation and continuation of organic farming. For example, financial support for organic agriculture offered for the period of 4-5 years is implemented in Germany and the UK.
- **Technical assistance and regular visits for monitoring**: In order to be certified as 'organic farming", various rules and regulations are to be followed. Hence, technical support along the transition process

from conventional chemical-based agricultural practice to organic farming is a necessary element provided to famers for successful uptake of organic farming support policy. Regular visits by local government officers for monitoring is required to ensure compliance of the direct payment support program.

- **Complementary supports**: Provision of marketing support, organic certification advisory and raising public awareness on contribution of organic agriculture on environment, food safety, and climate change would contribute to long-term development of organic farming in the country.

8.2.2 Direct payment for environmentally friendly best management practices

Best management practices refer to a wide range of practices applied on farmland in order to address negative externalities and/or provide agri-environmental public goods and services. In Thailand, soil conservation practices (such as establishing grass strips, planting of cover crops), substitution of agro-chemicals with organic substances (manure, bio-insecticides) and integrated pest management (IPM) have long been promoted to farmers to address environmental problems derived from agriculture. Governmental support provided to farmers has been mostly in the form of provision of inputs and technical assistance. Certain types of conservation practices such as grass strip establishment reflect opportunity costs in forms of long-term benefit foregone on the applied areas. In addition, the effects of these long-term benefits foregone are considered more substantial on small farms than large farms. Hence, financial incentives would enhance farmers' adoption and continuation of the long-term conservation practices. In the case of environmental sensitive areas such as erosion-prone hillsides, wetlands, biodiversity-rich areas and watersheds, direct financial payment can also be applied as an incentive for farmers to adopt extensive agricultural and biodiversity conservation practices.

Scientific knowledge is required to support certain conditions and requirements of each conservation practice. For example, a minimum requirement of land areas under conservation and specific practices (such as the width of buffer strips) required for effective erosion control and protection of nutrient run-off onto waterways need to be specified based on scientific groundwork. Determination of payments requires careful consideration of both benefits accrued to society and costs incurred on farmers including implementation and maintenance of the conservation measures, and long-term opportunity costs of land under conservation. Long-term commitment for financial support to farmers is again crucial for sustaining provision of agri-environmental public good and services derived from best management and conservation practices. Close cooperation between farmers and local government officers responsible for program implementation and provision of information and knowledge related to agri-conservation practices are considered as complementary elements supporting the successful program uptake. Establishment of a monitoring system is necessary to ensure compliance and pursue continuation of program participation.

8.2.3 Financial support for collective action in supporting multifunctional agriculture at group-based/ community-based level

Different from the previously proposed measures incentivizing individual farmers to participate in agri-environmental measures, financial incentive need to be offered to support collective action in promoting

multifunctional agriculture within farming communities. This would reduce transaction costs of implementing agri-environmental incentive-based policy measures. A combination of top-down and bottom up approaches can be seen from this type of policy measure. Provision of financial incentive derives from top-down policy implementation, while community-based projects in addressing local agri-environmental issues submitted for financial support are based on a bottom-up approach. Based on existing formal and informal farmer groups in organic agriculture, group-based financial support measures can also be applied to enhance organic farming at larger scale. Aspects of implementation discussed in 8.2.1 are applicable under this group-based measure. Furthermore, with an additional element on agro-tourism, community-based financial support in promoting multifunctional agriculture not only offer agri-environmental pubic goods and services to society, but also contribute to rural development at the community level. Cooperation between local government agencies and communities are essential for community-based project development to be submitted for financial support. Scientific knowledge and expert advice provided by government is essential for identification of agr-environmental issues to be addressed within the community and formulation of an action plan accordingly. In addition, accommodating non-government organizations providing complementary support, such as organic certification services, could help facilitate the program implementation at community level.

8.3 Institutional requirements for accommodating direct incentive payment measure in promoting multifunctional agriculture in Thailand

A major premise for the successful promotion of “Multifunctional Agriculture” is that knowledge and understanding of its basic concepts and functions is provided to all related economic sectors and to all strata of society. This could be achieved by creating information material in various forms, such as flyers, brochures, short documentaries on TV, policy briefs, seminars and workshops for farmers, agricultural extension workers, government agencies, policy-makers and the wider public. Multi-stakeholder meetings and roundtables should be organized to provide a common understanding of the concept of multifunctionality and its wider benefits to society as a whole. Speakers from various OECD countries that have long-standing experience with incentive-based mechanisms to promote multifunctional agriculture could be invited to these meetings in order to share information across various countries. Only then it is likely that the political will is created among agricultural policy-makers to support multifunctional agriculture across the country through the right combination of legal and fiscal policy measures.

Deviating from the conventional role of agriculture – i.e. to produce food, feed and fiber, multifunctional agriculture is based on a holistic approach taking into account of interaction among human and environmental system in providing not only private consumptive goods, but public consumptive and non-consumptive goods and services. Hence, expertise from various disciplines is required to successfully promote multifunctional agriculture.

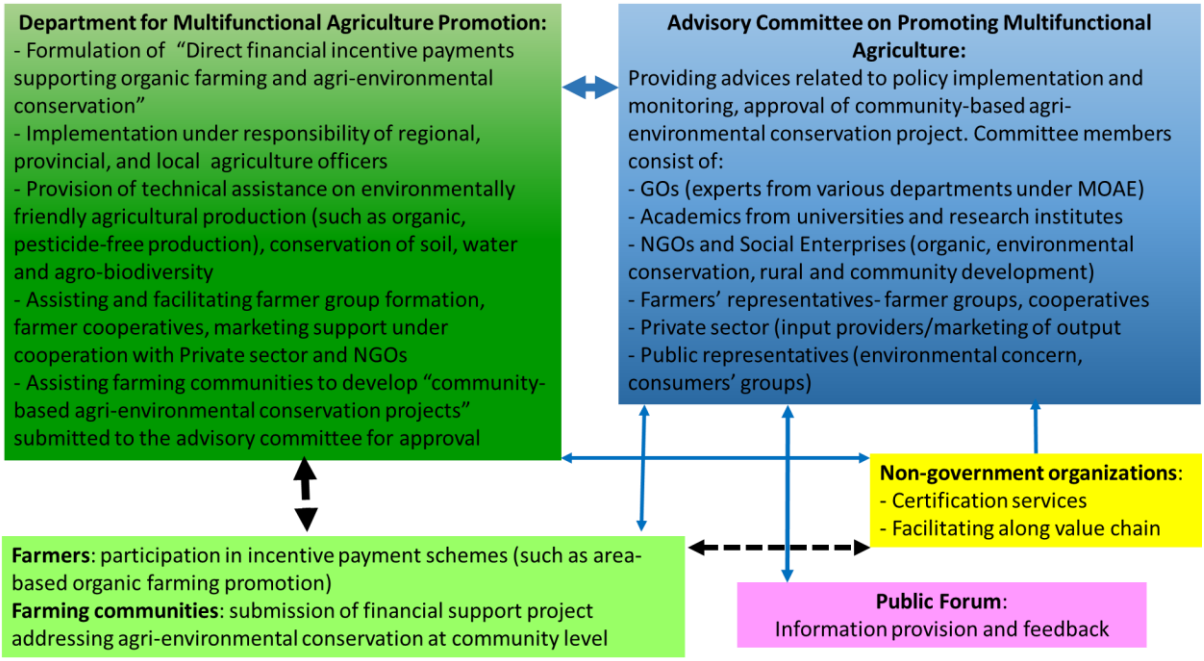
Under the Ministry of Agriculture and Cooperatives (MOAC), the structure of organization is generally based on specializations and mono-disciplines with vertical administration at central, regional, and local levels. With respect to the holistic approach of multifunctional agriculture, based on the existing institutional structure, close

cooperation among internal departments within MOAC providing both horizontal and vertical integration are important factors for implementation and monitoring of agri-environmental incentive policy measures. An advisory committee comprising experts from various departments at central level could be formed to oversee agri-environmental policy formulation and implementation. In addition, representatives from all stakeholders including farmer groups or farmer cooperatives, NGOs, academics, representatives from private and public sector (such as consumer groups with food safety and environmental concern) should be invited as committee members. The establishment of a new department focusing on multidisciplinary and holistic approaches to multifunctional agriculture could be an option for institutional arrangement for agri-environmental policy formulation and implementation.

Involvement of non-government organizations as third parties to help facilitating and supporting certain activities is also necessary. For example, organic certification processes and strengthening of cooperation within community and farmer groups could be supported by Organic Agriculture Certification Thailand (ACT), and Green Net Cooperative. In addition, setting up a basis for tri-party collaboration among GOs-NGOs-communities/farmers could enhance successful implementation of agri-environmental incentive-based policy measures in promoting multifunctional agriculture in the country. Private sector's involvement is also important particularly for the marketing aspect.

Involvement of the public sector as both the receptor and provider of information with regard to public policy in general is also considered necessary. Under the well-developed social media system, various channels could be utilized as platforms for communication among GOs, NGOs, community/farmers and the public sector. Information provision with regard to multifunctional agriculture by governments would enhance public understanding and awareness. Feedback and concern from public sector in various issues related to multifunctional agriculture, such as food safety, conservation of biodiversity and environment, provide the government, farmers and communities with a reflection of society's attitude and preferences with regard to the promotion of multifunctional agriculture using agri-environmental incentive-based measures. Area-based pilot programs to promote organic farming as mentioned by the current government could be a good starting point to implement the direct incentive payment measure. The proposed institutional arrangement to promote multifunctional agriculture using direct incentive payment as shown in Figure 8.2.

Figure 8.2 Proposed Institutional Arrangement in Promoting Multifunctional Agriculture



The proposed incentive-based payment measures to promote multifunctional agriculture rely heavily on "availability of budget". In addition, an important aspect of long-term budgeting commitment is crucial to ensure continuation of agri-environmental conservation practices which consequently achieves sustainability of multifunctional agriculture. Under budget constraints, it can be argued that the production of ecosystem services through multifunctional agriculture provides (1) wider societal benefits, such as safer food and more diverse landscapes (2) produces a number of public goods, such as landscape beauty and reduced GHG emissions and (3) contributes to various sustainable development goals (SDGs), such as life on land, good health and well-being and clean water and sanitation. Therefore, the allocation of the budget to support the agri-environmental incentive-based policy measures would be justified. Additional sources of budget could be added from international funding organizations, particularly when emphasizing the argument that multifunctional agriculture has not only national, but also global benefits, considering healthier ecosystems, wildlife habitats, reduced GHG emissions, and positive contributions to the SDGs. More importantly, political stability reflecting long-term budgetary support is crucial for ensuring the successful implementation of agri-environmental policy in promoting multifunctional agriculture in Thailand.

Chapter 9

Conclusion

Multifunctional agriculture and agri-environmental policy measures

In contrast to the conventional concept of "agriculture as the source of food and fibre production", a multifunctionality perspective emphasizes the multiple functions offered by agriculture to society which include not only production functions, but also ecological and socio-economic functions. The definition of multifunctional agriculture explicitly refers to a joint production process offering multiple outputs from the use of inputs. Commodity and non-commodity outputs, and private and public goods are the main characteristics of outputs obtained under the concept of multifunctional agriculture. To promote the provision of positive non-commodity outputs and discourage negative externalities from agriculture, a wide range of agri-environmental policy measures including economic incentive and command-and-control regulation measures addressing individual farmers, community-based policies, and complementary measures including institutional and persuasive instruments can be applied. Economic incentive measures are based on the idea that incentives, provided in various forms, would encourage farmers to produce positive non-commodity outputs, while disincentives are imposed on the production of negative ones. The economic incentive/disincentive measures range from different types of direct payments to farmers on the incentive side to taxes and charges on the disincentive side. Price-based measures refer to marketable or tradable permits and tender or reverse auctions as price-based measures provide incentives in cost-effective achievement of an environmental target. Unlike the economic incentive measures, compulsory compliance is required under regulatory and cross-compliance measures. Targeting at community or group-based level, incentives in the form of monetary and non-monetary support are provided to encourage collective action of farmer groups and/or farming communities in promoting multifunctional agriculture.

Agri-environmental policy measures: Countries' experiences

A wide range of agri-environmental policy measures has been implemented by eight selected OECD countries from four continents including Germany and UK, USA and Canada, Australia and New Zealand, and Japan and Korea. Their applications to address agri-environmental issues vary across the countries. In Germany and the UK, most agri-environmental policy measures are classified as "cross-compliance measures' under the "Second Pillar"-Rural Development Programmes of the Common Agricultural Policy (CAP) funded by the EU. Under the EU funding requirement, in order to be eligible to obtain financial incentive payments, farmers are required to comply with legislative standards in the field of the environment, food safety, animal and crop health, and animal welfare, and a range of standards on good agricultural and environmental practices. Agri-environmental programs implemented in many areas throughout Germany are supported under the "Second Pillar"-Rural Development Programmes of the Common Agricultural Policy (CAP). Each area-based program provides incentive payments to address various agri-environmental issues such as agricultural landscape and biodiversity preservation, organic farming, and soil and water resource conservation. In the UK, incentive payments are offered to promote a variety of best management practices in dealing with a range of agri-

environmental issues. In both countries, complementary supports are emphasized as a necessary element to successful implementation of agri-environmental incentive-based policy to promote multifunctional agriculture.

Similar to experiences in the UK, the adoption of agri-environmental conservation practices is incentivized by direct payments offered by the government to encourage the provision of positive public goods and services derived from multifunctional agriculture. In the US, nutrient credit trading program, a market-based measure, is implemented to address water quality improvement, whereby the involvement of the agricultural sector as non-point sources is limited only to suppliers of emission reduction credits. In Australia and New Zealand, agri-environmental issues are mainly addressed by the implementation of market-based and price-based measures. The application of permit trading schemes for water quality improvement focuses particularly on farms with the roles of both demanders for and suppliers of tradable permits. Reverse auction, a price-based measure, is implemented in Australia to achieve agri-environmental conservation at the least cost. Not as widely implemented as in other OECD countries mentioned earlier, direct incentive payments are offered to farmers to adopt agri-environmental conservation practices in Japan and Korea. Apart from incentive measures offered at farm-level, community-based measures are implemented to encourage collective action in promoting agri-environmental conservation practices across the selected OECD countries. In addition, complementary support mechanisms are emphasized as a necessary element to successful implementation of agri-environmental incentive-based policy to promote multifunctional agriculture in all countries.

Lesson learned from selected OECD countries' experiences in agri-environmental policy implementation

Based on a review of assessments on agri-environmental policy measures implemented in the selected OECD countries, financial support provided throughout the whole range of economic incentive measures including direct payment, market-based, price-based, and community-based measures, is considered a major factor contributing to the success of policy implementation in addressing agri-environmental issues. Compatibility of promoted agri-conservation practices with existing farming systems also has a positive influence on farmers' decision to participate in the direct incentive program. With regard to farmers' characteristics, farmers' environmental concerns and awareness positively enhanced agri-environmental incentive-based program participation. On the other hand, farm size, intensive farming, fertility of farmland, financial performance, and dominance of farm income in total household income discourage policy participation. Social capital referring to sharing common environmental concerns/values, understanding and willingness in pursuing agri-environmental conservation, strong leadership and cohesion among community members significantly contribute to successful implementation of community-based programs with the bottom-up approach in identifying agri-environmental issues to be addressed. Complementary support not only from local government in providing information, technical assistance and regular visits, but also from non-government organizations in facilitating the program are necessary elements contributing to the successful implementation of incentive-based policy measures at farm and community levels. Failure to take into account the time dimension of agri-conservation conservation practices (such as long-term processes of conversion and maintaining organic farming, establishing long-term conservation measures), shifting in government funding policy, and increasing compliance costs due to rigid

requirements of funding support have the potential to become barriers for implementation of farm-based and community-based direct incentive policy measures.

Under the market-based and price-based measures, flexibility and financial incentives are factors enhancing successful program implementation measures in achieving cost-effective environmental quality improvement. However, major barriers stem from the system complication from imposed trading rules and restrictions, difficulties in monitoring particularly for the cases of pollution loading from agricultural non-point sources, and negative impacts on farmland value and social cohesion within farming communities. Conservation tender, a price-based measure, provides least cost of long-term conservation in farmland. Landholders' altruistic attitude and concern about the environment together with strong relationship between landholders and implementing agencies are crucial factors for the success of this measure. Long-term duration of contract under conservation tender, price-based measure, potentially discourage farmers' participation due to uncertainty of future farmland value.

Proposed agri-environmental incentive-based policy measures to promote multifunctional agriculture in Thailand

Three major policy measures are proposed that have the potential to promote multifunctional agriculture in Thailand. These are 1) direct payment at farm level for organic farming, 2) direct payment at farm level for environmentally friendly best management practices, and 3) financial support for community-based programs in promoting multifunctional agriculture (such as organic farming, environmentally friendly best management practices, and agro-tourism). Financial payments for conversion to organic agriculture are justifiable due to the various costs that farmers have to bear, i.e. those resulting from changes in their production system, but also from benefits forgone during the transition from conversion to organic farming. Major aspects of incentive measures to promote organic farming that need to be considered are types of payment, duration of payment, and complementary support mechanisms. Area-based payments are proposed not only during the conversion period, but also for maintaining the farmland under organic agriculture on a permanent basis. Because conversion from conventional to organic agriculture requires a certain transitional period, a long-term commitment for the provision of payment support is necessary to enhance farmers' participation and ensure continuation of organic farming. In order for a farm to be certified as 'organic', it is important to follow various rules and regulations. Hence, technical support along the entire transition process from conventional, i.e. chemical-based agriculture to organic farming is a crucial element that needs to be provided to farmers for successful uptake. This includes regular monitoring visits by local government officers to ensure compliance with the direct payment support program. Other measures include the provision of marketing support, organic certification advisory and raising public awareness on the positive contribution of organic agriculture to an improved environment, to better food safety, and to mitigating climate change. Altogether, these measures would contribute to the long-term development of organic farming in the country with substantial benefits to the environment and the society.

To address environmental sensitive areas in Thailand such as erosion-prone hillsides, wetlands, biodiversity-rich areas and watersheds, direct financial payment can be applied to incentivize farmers to adopt eco-friendly best management practices. In order to determine the payments, both benefits accrued to society and costs incurred on farmers including implementation and maintenance of the conservation measures, and long-term opportunity costs of land under conservation need to be carefully considered. There needs to be long-term commitment for financial support to farmers for sustaining the provision of agri-environmental public good and services derived from best management and conservation practices. The provision of technical assistance, information and knowledge related to agri-conservation practices together with the establishment of close cooperation between farmers and local government officers responsible for program implementation are important complementary support elements that will enhance the successful program uptake.

Group-based or community-based incentive payments should also be applied to promote multifunctional agriculture and agro-tourism at community level. This would not only provide agri-environmental pubic goods and services to the wider society, but also contribute to rural development at the community level. In addition to financial support, scientific knowledge and expert advice provided by government agencies are essential for identification of agri-environmental issues to be addressed within the community. In addition, non-governmental organizations that can provide complementary support, such as organic certification services, could also help facilitate the program implementation at community level.

The following institutional arrangements could be created to accommodate direct incentive payment measure in promoting multifunctional agriculture in Thailand. First, a new department with its regional and local offices under the Ministry of Agriculture and Cooperatives focusing on multidisciplinary and holistic approaches to multifunctional agriculture could be established. Its defined task would be to take responsibility in agri-environmental incentive-based policy formulation and implementation. Second, the involvement of all stakeholders including government and non-government organizations, private and public sectors, farmer groups and community representatives could be institutionalized in the form of a committee providing advice to the newly established department. Finally, building a platform for provision of information to and feedback from the public would be another essential element for enhancing public understanding and awareness in agri-environmental conservation.

Promoting multifunctional agriculture in Thailand through the introduction of the incentive-based payment measures proposed in this study will depend strongly on the availability of sufficient funds. A long-term budgeting commitment is therefore essential to ensure the continuation of agri-environmental conservation practices. Only then can the sustainability of multifunctional agriculture be achieved. The allocation of financial resources under budget constraints can be justified by the following argument. The provision of ecosystem services through multifunctional agriculture (1) generates wider societal benefits, such as food safety and landscape diversity (2) produces a range of public goods, such as landscape beauty and reduced GHG emissions and (3) contributes to a number of sustainable development goals (SDGs), such as life on land, good health and well-being and clean water and sanitation. Additional financial resources could be sought from

international funding agencies. The justification for the release of international funds would be that multifunctional agriculture has benefits not only at the national, but also at the global level, when considering healthier ecosystems, conservation of wildlife habitats, reduced GHG emissions, and positive contributions to the SDGs.

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