Friday October 19th – AESI Early Career Researcher Seminar 2012

Room G01, UCD Agriculture and Food Science Centre

UCD, Belfield, Dublin 4, www.ucd.ie

09.30	**Introduction and Tea/Coffee**	
	First Years (10 mins presentation + 5 mins questions)	
9.45	Recent developments in the productivity of the dairy sector	Patrick R. Gillespie (Teagasc/NUIG)
10.00	Mediating 40 shades of green: a participatory action research approach in the Irish agricultural extension system	Catherine Seale (Teagasc/OU)
10.15	Welsh farmers' knowledge, willingness to adapt to, and attitude towards climate change	John Hyland (Bangor)
10.30	The Almon model and the transmission of prices from the dairy farmer to the consumer in Ireland	Charlotte Mahon (Eurostat)
	Second Years plus (15 mins presentation + 5 mins questions)	
10.45	The scientific and economic valuation for the environmental benefits of on-farm anaerobic digestion	John Walsh (Bangor)
11.05	**Tea/Coffee Break**	
11.30	Young farmer innovation practices for agricultural and rural development	Jessica McKillop (Teagasc/UCD)
11.50	Promoting innovation in Irish food processing firms: exploring the role of intermediaries in the innovation networks	Beste Yildiz (Teagasc/QUB)
12.10	Addressing system problems: development of an innovation broker	Christina Ryan (Teagasc/NUIM)
12.30	Case study: the potential economic impact on agriculture of possible freshwater pearl mussel protection strategies	Aksana Chyzheuskaya (Teagasc/NUIG)
12.50	**Lunch, Judges' Deliberations & Presentation of Prizes**	
14.00	**Close**	

Judges: Brendan Riordan (research economist) and Michael Wallace (UCD)

Recent developments in the productivity of the dairy sector

Patrick R. Gillespie

Introduction and Background

A lively and robust literature around the concept of dairy productivity has developed in recent years. Much of this has been motivated by the ongoing reforms of the Common Agricultural Policy (CAP), and the focus on dairy productivity is intensifying in anticipation of the abolition of the Milk Quota regime in 2015.

One study which examined the components of productivity was due to Carroll, Newman, & Thorne (2008). Amongst other analyses, the research examined the determinants of technical efficiency and found that efficiency levels are positively correlated with extension use, soil quality, the overall size of the farm, the level of intensification (livestock systems) and the level of specialisation. The use of artificial insemination was also explored in the Dairy and Cattle Rearing sectors, but was found to be significant in the Dairy Sector only. Furthermore, the work explored the effects of decoupling by including a decoupled variable alongside the efficiency inputs, but it found no significant effect for decoupling, and the direction of the relationship was only consistent with expectations in the cattle and sheep sectors.

As part of ongoing work, the authors have undertaken to update the results of this analysis with respect to the dairy sector. The most recent years of data from the National Farm Survey (NFS) are added to the analysis period. Two reasons to do this suggest themselves immediately; the first is that the effect of decoupling may have been muted or delayed in the first few years after the policy change, and this lack of variation in the underlying data may have caused the failure of the model to capture its effect. The second reason relates to the increased volatility in world dairy markets just as the sector begins to find itself more exposed to those markets. Has the increased volatility lead to higher Total Factor Productivity (TFP) as farms respond to the incentive to improve efficiency? If so, how has this change broken down in terms of the components of TFP?

Methodology

Coelli, Rao, O'Donnell, & Battese (2005) ascribe the measurement of efficiency in modern productivity analysis to three basic branches. Namely these are the use of deterministic models, the use of stochastic models, and the use of indices. This analysis makes its contribution by using the second branch and third branches, or the Stochastic Frontier Analysis (SFA) family of models and Malmquist indices respectively. A True Random Effects model (Greene, 2005) is specified, and the resulting estimates of TFP are used to construct Malmquist indices of the various components of efficiency which are plotted over time.

References

Carroll, J., Newman, C., & Thorne, F. (2008). *An Examination of the Productivity of Irish*

Agriculture in a Decoupled Policy Environment. Trinity College Dublin, Department of Economics.

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. New York: Springer Verlag.

Greene, W. (2005). Fixed and Random Effects in Stochastic Frontier Models. *Journal of Productivity Analysis*, *23*(1), 7-32. Springer Netherlands.

MEDIATING 40 SHADES OF GREEN: A PARTICIPATORY ACTION RESEARCH APPROACH IN THE IRISH AGRICULTURAL EXTENSION SYSTEM

Catherine Seale

PhD Student
Teagasc and the Open University (Walsh Fellow)
Research Commenced April 2012

Agricultural extension systems have traditionally relied on a top-down approach with a considerable emphasis on the transfer of technology (TOT) in a linear movement from experts to farmers. Although the TOT model has been extremely successful in many sectors, it does not always have the desired effect in agricultural extension (Chambers & Ghildyal 1984) The model has also been blamed for hindering the process of sustainable agriculture (Ison, 1990).

Agricultural knowledge transfer systems in Ireland are required to promote the sustainability of agriculture and must therefore develop a ground-up approach to integrate the economical, social and environmental realities of the European Union's Common Agricultural Policy (CAP) reforms currently under construction. These reforms are due to be confirmed in 2013 and likely to enact immense change as attempts are made to 'green' Pillar One by introducing environmental practices that go beyond cross-compliance. It has been argued that such steps are essential if the CAP is to react to emerging environmental challenges (Hart and Baldock, 2011).

The "greening" measures currently proposed by the CAP reforms will be mandatory in order for a farmer to be assured of the full Single Farm Payment historically drawn down. The measures are currently projected to include the required maintenance of permanent pasture, crop rotation and the introduction of ecological focus areas (EFA). Reaction to the reforms has been mixed, with a wide ongoing debate. Critics according to Alan Matthews (2012) are concerned that the reforms:
"*will be cumbersome and costly to implement, of doubtful environmental value and that they would reduce the ability of the EU to increase food production in response to the global tightening of food supplies* (p.2)".

The Agricultural Commissioner at the European Commission stated at the United Nations Conference on Sustainable Development in Rio (2012) that "sustainable agriculture is not a luxury but a necessity. It concerns us all, whether we live in Europe or on any other place on Earth"[1]. This concern is reflected in the 'greening' measures although what "sustainable agriculture" actually means at either farm level or in the minds of society is extremely difficult to gauge with many conflicting opinions. Such variety is inevitable. It must be

[1] http://ec.europa.eu/commission_2010-2014/ciolos/headlines/news/2012/06/20120621b_en.htm Accessed 19th July 2012

recognised and tackled particularly if trying to mediate agreements between actors with very different agendas (Pretty, 1995).

It is likely that the above criticisms and divergence of opinions will continue if the CAP reforms are implemented. It may prove beneficial during this policy transition for organisations such as Teagasc to adopt a participatory action research (PAR) approach in knowledge transfer processes.

Participation, asserts Pretty (1995), is an essential component of any system of learning, as no change can be affected without the full involvement of all the stakeholders and the adequate representation of their view and perspectives. The PAR approach in agricultural research and extension could help achieve representation by changing power structures, putting the farmer in charge of research direction and focus and by providing the farmer a key role in decision making. As such the PAR approach effectively democratizes science by engaging the subjects of research as active and equal participants (Ortiz 1991; MacLure & Bassey 1991).

The PAR Research Project

This PAR research will explore attempts to create "spaces for learning" (High, 2002) where the sustainability of agriculture may be discussed and contemplated in a contemporary "conversation" (Talbott, 2009) .The research should significantly assist Teagasc in developing its extension programme for Teagasc's clients, the farming community at large as well as providing benefits to those with a stake in the countryside and its management.

My research question seeks to examine how Teagasc could use a PAR approach to develop and use its extension service to provide research that is balanced in terms of ecology and economy both at farm-level and in the terms of the wider communities perceptions' of what sustainable agriculture should provide under a greener CAP with specific reference to the proposed EFA.

My proposed paper for the AESI Early Career Researcher Seminar would include an examination of the 'greening' measures of the CAP, an introduction to the PAR process and its function in agricultural extension, and a road map of where this PAR research may go in mediating change and reaching agreement that benefits those involved in the research project. The paper will also include a summary of the methods I propose using for exploring the strengths and weaknesses of the PAR research process.

Supervisors:

Dr. Aine Macken-Walsh	-	Teagasc
Professor Andy Lane	-	The Open University
Dr. Christopher High	-	The Open University
Dr. Martin Reynolds	-	The Open University

Welsh Farmers' knowledge, willingness to adapt to, and attitude towards climate change

John Hyland

Supervisors: Dr. Prysor Williams & Prof. Davey Jones.
School of Environment, Natural Resources & Geography, Bangor University, Bangor, Gwynedd, Wales.

Research motivation

Livestock production systems need to change in the face of climate change. To increase current production and income levels, production systems must become more resilient while at the same time act in an environmentally responsible manner. Research is increasingly focusing on developing mitigation methods that can help alleviate the environmental impact of livestock production. However, it is equally important for policy-makers to understand how farmers will react to climate change, and in particular how they would respond to initiatives and regulation that aim to reduce environmental impact of livestock systems. This understanding can be obtained through examining farmers' perceptions towards climate change.

Resent research shows heterogeneity among farmers' attitudes toward climate change. Hyperbolic discounting may explain some of the lack of uniformity and the dismissive nature of some of the farming community towards the issue. This process describes how people often apply a high discount rate to trades between the present and the near future, but a low discount rate for trades between the near and far future. Behavioural factors influence the outcome of policy incentives, either complimenting or constraining the effects of policy. It is therefore important to understand the differing factors that can facilitate or hinder implementation of adaption and mitigation actions.

Traditionally, the focus for policy-makers has been to change environment practices using external drivers such as taxes, subsidies and regulation. However, incorporating a wider understanding of individual and societal behaviour along with external drivers is critical for policy appraisal, selecting interventions and evaluation of effects. Public perception and knowledge of climate change increasingly plays an important part in shaping environmental policy and management response systems. To generate effective policies, there is a need to recognize the complexity of farmer attitudes and the multiple factors that influence decision-making.

Methods

A questionnaire was constructed which aimed to gather information of Welsh farmers' attitudes, values and intentions towards climate change and the wider environment. In total 49 questions were asked, capturing demographics, value and attitude statements, as well as questions on benefits, risks, on-farm GHG emissions and the risk that climate change poses to all of society in the future. Responses to attitude and value statements were measured across a standard 5-point Likert scaling, ranging from strongly agree to strongly disagree.

The survey was distributed at various livestock markets, agricultural shows, farmers' union meetings, and agricultural events throughout Wales in the summer of 2012.
Once data collection has been finished the next step in the research is to use the statements collected from the survey to construct types in order to describe the breadth of perception which exists within the Welsh farming community. Univariate and bivariate analysis will be conducted to indicate standard distributions and frequency of responses. The data will be then used to construct the typology based type based on responses to statements via principle component analysis (PCA) and cluster analysis. This typology approach supports diversified engagement strategies and may indicate to policy-makers where focus should be concentrated.

Results

Initial results (>140 completed questionnaires) show that there is a general uncertainty amongst Welsh livestock farmers towards a number of climate change related statements, such as 'Livestock farming contributes to climate change'. Most either agreed or strongly agreed with the statement 'I want to farm as environmentally friendly as possible'. However, perhaps of concern to policies which rely on voluntary adoption are the levels of disagreement with some statements, with a considerable proportion of farmers disagreeing with the statement 'I find information on climate change easy to understand'. General responses to statements are useful in summarising perceptions of farmers, in particular the level of uncertainty which exists in terms of its impact. A mean PCA score for different clusters shown on radar graphs will give a visual representation of the typologies that exist within the Welsh livestock industry in regards to climate change. Ultimately, the information gathered will be fed to industry stakeholder groups and to policy-makers to help develop acceptable and effective climate change mitigation measures for the livestock sector.

The Almon Model and the Transmission of Prices from the Dairy Farmer to the Consumer in Ireland

Charlotte Mahon[1], Frédéric Gaspart[2], Garry Mahon[1], Bruno Henry de Frahan[2]

[1]Statistical Office of the European Union, Luxembourg
[2]Université Catholique de Louvain, Belgium

Following the steep rise in food prices in 2007, the European Commission (2009) issued a communication to follow price development along various food supply chains. In this context, Eurostat created the Food Price Monitoring Tool, in order to "increase transparency along [each] food supply chain to encourage competition and improve its resilience to price volatility". The tool includes a collection of price indices for successive points of the supply chain, for example, farm gate, factory and consumer. Eurostat expressed an interest in the development of a framework to describe and measure the patterns of price transmission from one step of the chain to the next. We evaluate the Almon (1965, 1968) model, a structured finite distributed lag model, as a means to meet this need. The model has the advantages of being flexible, i.e., not assuming that the relationship between the price indices is the same over the whole period (Gujarati, 2003). It has the disadvantage that the explanatory variables may be highly correlated, with consequences for statistical inference.

Four series of price indices are obtained from the StatBank database of the Central Statistics Office, Ireland: (i) Agricultural Input and Output Price Indices by Month and Agricultural Product – Milk, (ii) Industrial Price Index by Month and Industry Sector NACE Rev 2 - Dairy products, (iii) Consumer Price Index by Month and Detailed Sub Indices – Milk, and (iv) Consumer Price Index by Month and Detailed Sub Indices - Other milk products. The first two indices have base year 2005=100. The other two have base December 2006=100 and are re-referenced to year 2005=100. Quarterly series are derived from the monthly ones by taking the indices for March, June, September and December.

The Almon model may be written:

$$Y_t = \alpha + \alpha_0 \sum_{i=1}^{k} X_{t-i} + \alpha_1 \sum_{i=1}^{k} iX_{t-i} + ... + \alpha_m \sum_{i=1}^{k} i^m X_{t-i} + \nu_t$$

where Y_t is the downstream price index at time t, X_t is the upstream price index at time t, k is the maximum number of lagged periods, i is an indicator, m is the largest power of the indicator ($m<k$), the α's are regression coefficients and v_t is the error term. The value of k is set to 8, i.e. two complete annual cycles, and m to 7.

One may write: $Z_{0t} = \sum_{i=1}^{k} X_{t-i}$ $Z_{1t} = \sum_{i=1}^{k} iX_{t-i}$ … $Z_{mt} = \sum_{i=1}^{k} i^m X_{t-i}$

and obtain: $Y_t = \alpha + \alpha_0 Z_{0t} + \alpha_1 Z_{1t} + \alpha_2 Z_{2t} + ... + \alpha_m Z_{mt} + \nu_t$

The coefficients α_m are estimated by ordinary least squares (OLS) and all calculations are carried out using Microsoft Excel 2003 or 2010.

By regressing the industrial price index for dairy products on the agricultural price index for raw milk, i.e., farm gate to factory, and consumer price index for milk on the industrial

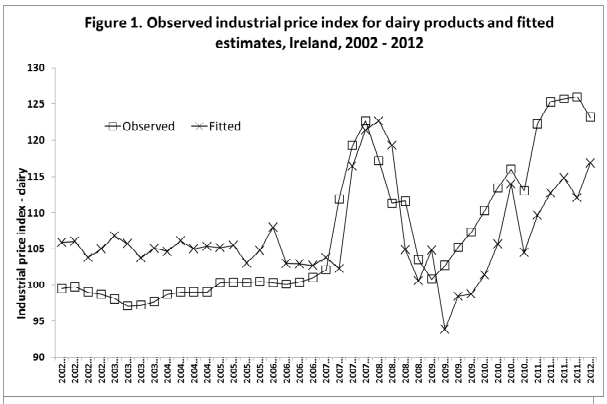
price index for dairy products, i.e., factory to consumer, the following results are obtained. For the first step, farm gate to factory, the F value for the regression is 2.97 with 8 and 32 degrees of freedom and a P value of 0.013 (significant). For the second step, factory to consumer, the F value is 6.13 and a P value of 0.00016 (highly significant). The results for the regression of the consumer price index for *other milk products* on the industrial price index are very similar to those for the regression of the consumer price index for *milk* on the industrial price index, and so the former are not shown.

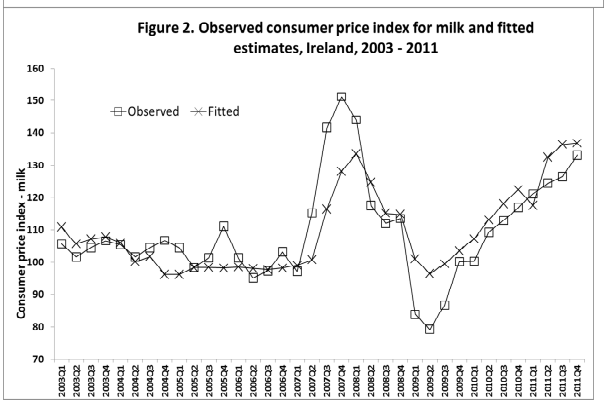
Preliminary results reported in Table 1 show a similar pattern of alternating signs for the regression coefficients for both steps of the supply chain. The large standard errors of the regression coefficients in spite of the significant F values may be due to the correlation amongst the explanatory variables (*Z*'s).

Table 1. Regression of ex-factory price index for dairy products on the lagged weighted farm-gate price index for raw milk and consumer price index for milk on the lagged weighted ex-factory price index for dairy products, Ireland, 2002-2012

	Farm gate to factory		Factory to consumer	
Parameter	Coefficient	Std. error	Coefficient	Std. error
α	78.67	25.49	-48.22	23.01
α_0	20.14	51.95	16.21	23.73
α_1	-44.60	127.03	-30.00	57.98
α_2	38.15	118.24	22.65	53.96
α_3	-16.74	55.71	-9.092	25.42
α_4	4.140	14.594	2.108	6.661
α_5	-0.584	2.153	-0.284	0.983
α_6	0.0438	0.1671	0.0206	0.0024
α_7	-0.0014	0.0053	-0.0006	0.0053

Source: Statbank, CSO, Ireland





Source: Statbank, CSO, Ireland

Figures 1 and 2 show that in each case the fitted curve reproduces the general features of the observed one. In particular, the price stability from 2002 to 2006, the rise in 2007, the decline in 2008 and 2009, and the second rise from 2009 to 2012 are well represented. However, for the relationship between the raw milk price index and the ex-factory product price index in Figure 1, the observed values are less than the fitted ones for 2002 to 2006, and greater for 2009 to 2012. For the relationship between the ex-factory price index and the consumer price index in Figure 2, the observed peak in 2008 is higher than the fitted one, and the observed trough in 2010 is deeper than the fitted one.

This study is at an early stage and progress so far constitutes a proof of concept concerning the usefulness of the Almon model to represent price transmission in a food supply chain. Next steps will include the study of further supply chains (meat, cereals versus bread, etc.) and Member States (Belgium, France, Germany, Luxembourg, the Netherlands and the United Kingdom). The question of the correlation amongst the explanatory variables will be addressed.

References

Almon, S.M. (1965) The distributed lag between capital appropriations and expenditures, *Econometrica*, 33: 178-196.

Almon, S.M. (1968) Lags between investment decisions and their causes, *Review of Economics and Statistics*, 50: 193-206.

European Commission (2009) Communication from the Commission to the European Parliament, the Council, The Economic and Social Committee and the Committee of the Regions, A better functioning food supply chain in Europe.

Gujarati, D. (2003) Basic Econometrics, 4th edition, McGraw-Hill, 1002 pp.

The scientific and economic valuation for the environmental benefits of on-farm anaerobic digestion

John Walsh

Supervisors: Prysor Williams, Davey Jones, Gareth Edwards-Jones.
All based at the School of Environment, Natural Resources & Geography, Bangor University, Wales

Anaerobic digestion (AD) is the biodegradable decomposition of organic material in an oxygen free environment, at either psychrophilic, mesophilic or thermophilic temperatures. The digestion process results in the production of two commodities, biogas (typical methane value 60 – 70%), which is burnt to generate electricity and a high nutrient rich digestate fertilizer, for application to land. For this reason, AD is primarily seen as a source of low-carbon renewable energy.

However, the introduction of AD can bring about a number of additional positive environmental and social external benefits above those provided by other forms of renewable energy, including reductions in pathogens, odour, the biological and chemical oxygen demand of wastes, and greenhouse gas emissions. The aim of this research was to quantify the economic value of all the non-market benefits associated with on-farm AD.

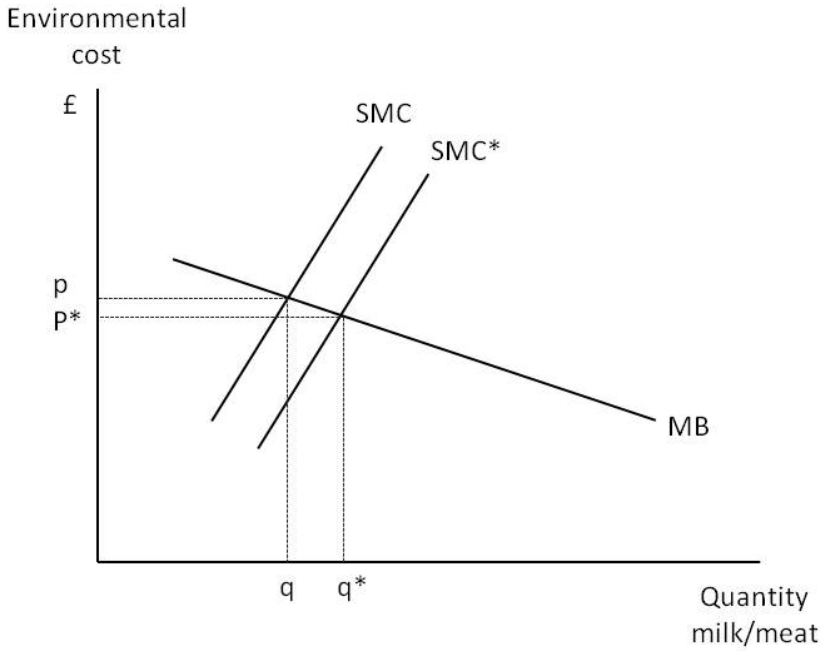
Firstly, a study was designed to determine if differences may exist in the yield of grass and the leaching of nutrients following the application of either digestate generated from the digestion of cow slurry, undigested cow slurry or synthetic fertilizer (dose rate equivalent to 150 kg N^{-1}). In addition to this work, soil samples were analysed throughout the course of the experiment to determine if application of the different fertilizer types affect the soil decomposer community. The findings were collated with those from other studies and were fed into an economic valuation that used a number of different economic valuation tools to determine the true value of AD. These ranged from people's willingness to pay for reduction in pathogen infection, to the cost of water damage and hedonic property valuation to determine the value of odour reduction on property values.

It was shown that the yields achieved when grass was applied digestate were statistically equal to, or better than yields of grass applied synthetic fertilizer, and consistently better than when grass was applied undigested slurry. Digestate did not restrict clover growth as much as synthetic fertilizers; which would be of benefit to farms as increased clover reduces the need for expensive fertilizer due to its ability to fix nitrogen. It was found that the bacterial community of the soil that had been applied digestate was of similar structure as when synthetic fertilizer was applied, while both had statistically higher bacterial growth than undigested cow slurry. A further environmental benefit than just the potential reduction in synthetic fertilizer use was that there was less leaching of nutrients from grass applied digestate rather than synthetic fertilizer. Collectively, these results indicate that digestate could act as an effective replacement to synthetic fertilizer and provide better nutrient recovery than applying undigested cattle slurry. From these results and from other

studies, we subsequently calculated the value of the positive external environmental benefits if 1% of the UK's animal manure (cattle, pig, and chicken) was subject to AD prior to land-application. Depending on the parameters used, then non-market value ranged from €5 and €18 million per annum. These findings indicate that AD is currently undervalued by government as a source of renewable energy. We conclude that AD should therefore be valued differently to other sources of renewable energy so as to reflect the wider environmental benefits it delivers, in addition to the replacement of fossil fuels.

Figure 1 gives a graphical representation of the effect that the introduction of AD can have to the modern farming system. As profit margins get smaller in farming, farms will have to increase herd size in order to achieve economies of scale. This increase in herd size under the same land mass will inevitably lead to increase in pollution associated with agriculture. However, as AD is a pollution abatement technology as much as a renewable energy provider, farmers that adopt AD can increase production at a lower environmental cost per litre/kg of milk meat produced.

Figure 1. Increase in production with an associated decrease in pollution



Note: As milk and meat consumption increase, the individuals' marginal benefit (MB) per litre/kg will decrease. This increase in consumption would also increase the environmental damage associated with increased production. However, the introduction of AD would lower the environmental price per litre/kg of milk/meat produced; dropping the environmental cost from price p to p* at an increase in quantity of milk/meat from q to q* thus shifting the social marginal curve (SMC) to SMC*, leading to a movement along the MB curve.

Young farmer innovation practices for agricultural and rural development

Jessica McKillop

2nd year PhD Candidate

Supervisors: Dr. Kevin Heanue (Teagasc) & Dr. Jim Kinsella (UCD)

Research questions

1. What are the significant factors which determine young farmer involvement in innovation practices?
2. To what extent is the generation and exchange of knowledge as well as its' application/s by young farmers influenced by social networks?
3. How useful is the innovation systems framework for understanding young farmer innovation?

Motivation for the work

The Food Harvest Report 2020 outlines target levels of growth for each sector of the agricultural economy. For example, the dairy sector is expected to increase its milk production by 50% and the beef sector is to increase its output value in similar terms. The abolition of milk quotas in 2015 should facilitate such expansion for the dairy sector. Although full time farming income increased by 75% from 2009 to 2010 according to the NFS (2010), this increase only restored income lost over the previous years. Finally, the numbers of farmers with an off-farm job have declined due to the lack of opportunities in the current economy and, therefore, there is an increased reliance by farmers on their farming activity as a main source of income. These factors combined ensure that agricultural development must be at forefront of future planning to ensure a sustainable livelihood for all involved. The targets outlined by Food Harvest 2020 demand that expansion and growth takes place in the agricultural sector. In particular young farmers are important as they are the future landholders and have the potential to meet the targets set out.

Methodology

This research is focusing on young farmers between the ages of eighteen and thirty-five. Utilising the graduates of the agricultural colleges around the country has enabled access to the young farmer population. In particular the research will focus on process and organisational innovations. In terms of process innovations – financial management, grassland management and genetics will be examined. Organisational innovations will focus on farm partnerships, contract rearing and share farming.

The innovation systems approach remains the main framework for this study. Under this approach innovation is seen as a more "systematic, interactive and evolutionary term whereby networks of organisations, together with the institutions and policies that affect their innovative behaviour and performance, bring new products, new processes and new forms of organisation into economic use" (Hall: 2006:7). It focuses on all the actors and their interaction in the innovation process. It goes beyond the creation of knowledge and is not purely about discovery and imagination but rather innovation is seen in a social and economic sense (World Bank: 2006).

In particular Schumpeter's definition of innovation will be used for this research as it has a focus on process and organisational innovation. This definition is, "(1) The introduction of a new good – that is one which consumers are not familiar of– or new quality of good. (2)The introduction of a new method of production, that is one not yet tested by experience in the branch of manufacture concerned, which need by no means be founded upon a discovery scientifically new and can also exist in a new way of handling a commodity commercially. (3) The opening of a new market. (4) The conquest of a new source of supply of raw materials or half-manufactured goods (5) The carrying out of a new organisation of any industry" (Schumpeter:1934:66).

Analysis/key findings

From an analysis of secondary data using the National Farm Survey 2010 it is evident that young farmers represent just fewer than 6% of the farming population at a figure of 5543 approximately, whereas farmers above the age of 35 represent 93260. The average age of young farmer is 33 years. Further only 17% of young farmers participate in discussion groups of which the majority are dairy. Other analysis of the data highlighted that 72% of young farmers have advisory contact.

References

Department of Agriculture, Fisheries and Food (2010) "Food Harvest Report 2020" accessed at http://www.agriculture.gov.ie/media/migration/agri-foodindustry/foodharvest2020/2020FoodHarvestEng240810.pdf on 02/09/11

Hall, A., L. Mytelka & B. Oyeyinka (2006) "Concepts and guidelines for diagnostic assessments of agricultural innovation capacity" *UNU-MERIT Working Paper Series*.

Schumpeter, J. (1934), *The Theory of Economic Development – An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle,* Cambridge, Harvard University Press.

Teagasc (2010) National Farm Survey 2010.

The World Bank (2006) "Enhancing Agricultural Innovation: How to go beyond the strengthening of research systems" *Agriculture & Rural Development Series*, The World Bank Washington.

PROMOTING INNOVATION IN IRISH FOOD PROCESSING FIRMS: EXPLORING THE ROLE OF INTERMEDIARIES IN THE INNOVATION NETWORKS

Hatice Beste Yildiz[2] [a, b]

Supervisors: Prof Nola Hewitt-Dundas [b]; Dr Maeve Henchion [a]

[a] Teagasc Food Research Centre, Rural Economy and Development Programme, Ashtown, Dublin, Ireland

[b] Queen's University Management School, Belfast, Northern Ireland, UK

Abstract

The variety of actors in innovation networks has increased due to an intensified focus on 'open innovation' thinking (Laranja, 2009; Howells, 2006). Consequently, research on the roles of the actors and the links between these actors within a network has earned prominence (Yusuf, 2008; Howells, 2006). This is particularly the case for intermediary organisations who execute a variety of roles within networks (Howells, 2006).

This PhD project will investigate intermediaries with regards to innovation networks from the Irish food innovation system (FIS) in order to explore the role and characteristics of intermediaries in innovation networks; understand the mechanics of intermediaries' evolution and identify the determinants of success for intermediaries in Irish FIS.

1. Introduction

The consensus in the literature is that SMEs need external facilitation and support in term of problems such as their inability to identify appropriate partners and a sub-optimal knowledge base with which to absorb external knowledge (Collins and Hitt, 2006; Mowery et al., 1996; Lane et al., 2001; Lee, et al., 2010) with their innovation activities (Büchel and Raub, 2002; Bougrain and Haudeville, 2002; Cravens, et al., 1996; Lechner, et al., 2006; Pitt, et al., 2006; Thorgen, et al., 2009).

There is an undeniable need to increase innovativeness in Irish food processing firms to increase their competitiveness and sustainability to ensure the survival and growth of the Irish food industry (Arnold and Thuriaux, 2001; Henchion, Buckley and O'Reilly, 2010; Collins and Pontikakis, 2006; Golden, Higgins and Lee, 2003; Hilliard and Green, 2005). The food industry is a very important part of Irish economy in terms of employment, exports and GDP; thus the firm level innovativeness must be maximised for ensuring competitiveness and sustainability in order to strengthen the Irish food innovation system (Collins and Pontikakis, 2006; Department of Agriculture, Fisheries and Food, Ireland, 2011). SMEs expectedly draw attention in terms of firm level innovation within the Irish food innovation system, as they constitute 94 % of the food processing firms in Ireland (CSO, 2005).

In overcoming the problems faced by SMEs in engaging and benefiting from networks in Irish Food innovation system, attention has increasingly focused on 'intermediary' organisations, which are considered as a part of the Irish food innovation system as well (Henchion, Buckley and O'Reilly, 2007; Howells, 2006; Laranja, 2009; ; Pontikakis, et al. 2005[1], Pontikakis, et al. 2005[2]; Yusuf, 2008).

[2] Corresponding author. Contact e-mail addresses: beste.yildiz@teagasc.ie ; hyildiz01@qub.ac.uk

2. Intermediaries and Intermediary Roles

As the variety of actors in networks have increased due to the rise of the open innovation thinking, research on the roles of the actors and the links within a network has earned prominence (Howells, 2006). “Intermediaries” who execute a variety of roles within networks are one of the actors in networks that have become prominent recently (Howells, 2006).

The seminal work of Galaskiewicz and Krohn (1984) on intermediaries fundamentally defines intermediaries as a metaphorical distribution centre where the intermediary both collects and distributes resources from various parts of the network in which it is embedded. Watkins and Horley (1986), who also carried out one of the early examples of research on intermediaries, are also one of the first researchers who mention intermediaries in an innovation context. Later on, Gould and Fernandez (1989) point out that intermediaries may be internal or external to a network.

Intermediaries are defined and categorised diversely in the literature. However, they can be grouped into three main categories according to the nature of their roles. These three groups represent intermediaries which take on co-development of innovation (Howells, 1999; Laranja, 2009), facilitation (Obstfeld, 2005; Yusuf, 2008), advocacy roles (Lee, et al., 2010; Simard and West, 2006) and historical roles.

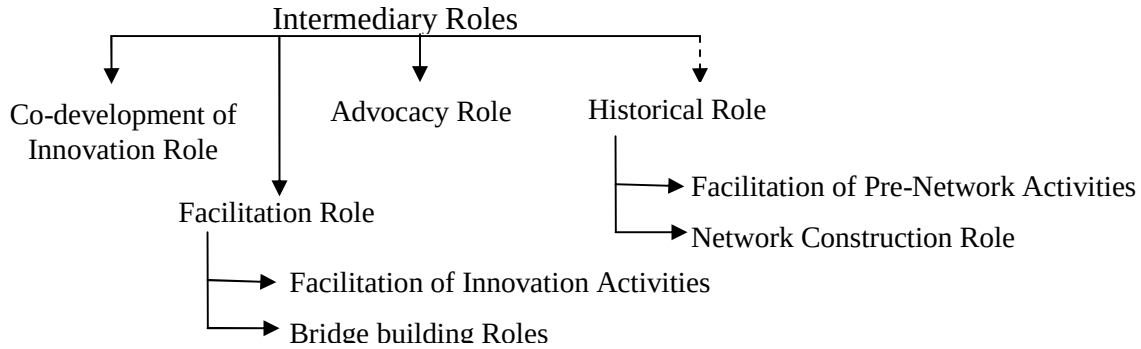


Figure 1. Summary of intermediary roles

Co-development of Innovation Role

Co-development innovation represents the **active** role of intermediaries in innovation networks, where they actively participate in the creation of innovations ‘along’ with the members of the network while enabling and enhancing their innovativeness (Batterink, et al., 2010; Stewart and Hyysalo, 2008; Zeng, 2010; Yusuf, 2008). This role involves activities such as introducing innovative know-how, training opportunities, qualified staff, etc (Dalziel, 2010; Inkinen and Suorsa, 2010; Yusuf, 2008); bringing in managerial know-how and skills such as risk assessment skills and trouble shooting skills (Lee, et al., 2010; Zeng, et al., 2010); and providing assistance in contractual matters, standardisation and specification issues, etc (Luukkonen, 2005; Hellmann and Puri, 2002).

Facilitation Role

The main role of the intermediary in network facilitation can be grouped in terms of:

- Intermediary activities regarding the facilitation of innovation activities such as:
  - Facilitation and support of transfer activities such as information flow (Yusuf, 2008; Howells, 2006);
  - Coordination of the network activities through planning and project management (Inkinen and Suorsa, 2010; Mehra, 2009; Stewart and Hyysalo, 2008; Yusuf, 2008; Howells, 2006);
  - Facilitation of the introduction of new ideas, knowledge, technology, etc from external sources into the network (Kirkels and Duysters, 2010; Gould and Fernandez, 1989).
- Bridge-building between members in terms of increasing communication effectiveness within a network and bridging the cultural gaps between the members of a network; and making external contacts available (Luukkonen, 2005; Obstfeld, 2005; Klerkx and Leeuwis, 2008; Stewart and Hyysalo, 2008; Lee, et al.,2010).

Advocacy Role

In summary, the main role of the intermediaries in advocacy is representing and protecting the interests of network members through activities such as lobbying (Howells, 2006; Lee, et al., 2010; Henchion and Sorenson, 2011).

Historical Role

The historical role of intermediaries are categorised separately than the other 3 main groups of roles due to the fact that these roles are performed by the intermediaries before the start of the networks' operation (Lee, et al.,2010; van Lente, et al.,2003). The roles in intermediaries before the actual lifecycle of the network can be grouped in terms of:

- Intermediary activities regarding the pre-network facilitation such as:
  - identifying needs and demand for the innovation and/or collaborations; and correlating objectives of economic outcomes and research/network activities (Goerzen and Beamish, 2005; Yusuf, 2008; Klerkx and Leeuwis, 2009);
  - constructing a dynamic framework and an action plan for the collaborative process, etc (Yusuf, 2008; Hoppe and Ozdenoren, 2005);
- Intermediary activities regarding bringing organisations together to form a network (Inkinen and Suorsa, 2010; Lee, et al., 2010; Simard and West, 2006).

Within the context of this study, an intermediary is a public or private body which performs one or more set of roles from the group of co-development of innovation and/or network facilitation roles and/or network governance roles in innovation networks.

3. Objectives and Key Research Questions

The research is concerned with the intermediaries with regards to innovation system that exists in the food processing industry in Ireland. The overall aim of this research is to explore the role and characteristics of intermediaries within the context of innovation networks and strengthen innovation in the Irish Food innovation system. Through examining the innovation system in food industry in Ireland, the research will identify ways in which effective networking between organisations can be strengthened with reference to intermediaries.

References

Arnold, E. & Thuriaux, B. 2001, "Contribution of basic research to the Irish national innovation system", Science and Public Policy, vol. 28, no. 2, pp. 86-98.

Bessant, J. & Rush, H. 1995, "Building bridges for innovation: the role of consultants in technology transfer", Research Policy, vol. 24, no. 1995, pp. 97-114.

Bougrain, F. & Haudeville, B. 2002, "Innovation, collaboration and SMEs internal research capacities", Research Policy, vol. 31, no. 2002, pp. 735-747.

Büchel, B. & Raub, S. 2002, "Building Knowledge-creating Value Networks", European Management Journal, vol. 20, no. 6, pp. 587-596.

Buckley, M., Henchion, M. & O'Reilly, P. 2007, "Interactions in Ireland's Food Innovation System", 1st International European Forum on Innovation and System Dynamics in Food Networks, eds. M. Buckley, M. Henchion & P. O'Reilly, European Association of Agricultural Economists (EAAE), Innsbruck-Igls, Austria, 15-17 February 2007, pp. `413.

Central Statistics Office 2005, Census of Industrial Production 2005, CSO, Ireland.

Collins, J.D. & Hitt, M.A. 2006, "Leveraging tacit knowledge in alliances: the importance of using relational capabilities to build and leverage relational capital", Journal of Engineering and Technology Management, vol. 23, no. 3, pp. 147-167.

Collins, P. & Pontikakis, D. 2006, "Innovation Systems in the European Periphery: the case of Ireland and Greece", Enlargement, Southern Europe and the Mediterranean, eds. P. Collins & D. Pontikakis, Centre for Innovation & Structural Change (CISC), NUI Galway, Ireland, 2006.

Cravens, D.W., Piercy, N.F. & Shipp, S.H. 1996, "New Organizational Forms for Competing in Highly Dynamic Environments: the Network Paradigm", British Journal of Management, vol. 7, no. 1996, pp. 203-218.

Department of Agriculture, Fisheries and Food, Ireland 2011, Annual Review & Outlook for Agriculture, Fisheries & Food, 2010/2011, Department of Agriculture, Fisheries and Food, Ireland, Republic of Ireland.

Galaskiewicz, J. & Krohn, K.R. 1984, "Positions, Roles, and Dependencies in a Community Interorganization System", The Sociological Quarterly, vol. 25, no. 4, pp. 527-550.

Golden, W., Higgins, E. & Lee, S.H. 2003, "National Innovation Systems and Entrepreneurship", Working Paper, CISC Working Paper No.8.

Gould, R.V. & Fernandez, R.M. 1989, "Structures of Mediation: A Formal Approach to Brokerage in Transaction Networks", Sociological Methodology, vol. 19, no. 1989, pp. 89-126.

Hellmann, T. & Puri, M. 2002, "Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence", The Journal of Finance, vol. LVII, no. 1, pp. 169-198.

Henchion, M. & Sorenson, D. 2011. “Formal Food-related Networks in Ireland: A Case Study Analysis”, *5th International European Forum on Systemic Dynamics and Innovation in Food Networks.* 14th February – 18th February 2011. Innsbruck-Igls, Austria.

Henchion, M., Buckley, M. & O'Reilly, P. 2010, Irelands Food Innovation System, Teagasc, Ireland.

Hilliard, R. & Green, R. 2005, "Innovation Policy Governance and Institutional Change in Ireland", DRUID Tenth Anniversary Summer Conference 2005, eds. R. Hilliard & R. Green, Centre for Innovation & Structural Change (CISC), NUI Galway, Denmark, 27-29 June 2005, pp. 1.

Howells, J. 2006, "Intermediation and the role of intermediaries in innovation", Research Policy, vol. 35, no. 2006, pp. 715-728.

Howells, J. 1999, "Research and technology outsourcing and innovation systems: an exploratory analysis", Industry and Innovation, vol. 6, no. 1999, pp. 111-129.

Inkinen, T. & Suorsa, K. 2010, "Intermediaries in Regional Innovation Systems: High-Technology Enterprise Survey from Northern Finland", *European Planning Studies*, vol. 18, no. 2, pp. 169-187.

Kirkels, Y. & Duysters, G. 2010, "Brokerage in SME networks", *Research Policy*, vol. 39, no. 2010, pp. 375-385.

Klerkx, L. & Leeuwis, C. 2009, "Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector", Technological Forecasting & Social Change, vol. 76, no. 2009, pp. 849-860.

Klerkx, L. & Leeuwis, C. 2008, "Balancing multiple interests: Embedding innovation intermediation in the agricultural knowledge infrastructure", Technovation, vol. 28, no. 2008, pp. 364-378.

Lane, P.J., Slak, J.E. & Lyles, M.A. 2001, “Absorptive capacity, learning and performance in international joint ventures”, Strategic Management Journal, vol. 22, no. 10, pp. 1139-1161.

Laranja, M. 2009, "The development of technology infrastructure in Portugal and the need to pull innovation using proactive intermediation policies", Technovation, vol. 29, no. 2009, pp. 23-34.

Lechner, C., Dowling, M. & Welpe, I. 2006, "Firm networks and firm development: The role of the relational mix", Journal of Business Venturing, vol. 21, no. 2006, pp. 514-540.

Lee, S., Park, G., Yoon, B. & Park, J. 2010, "Open innovation in SMEs - An intermediated network model", Research Policy, vol. 39, no. 2010, pp. 290-300.

Luukkonen, T. 2005, "Variability in organisational forms of biotechnology firms", Research Policy, vol. 34, no. 2005, pp. 555-570.

Lynn, L.H., Reddy, N.M. & Aram, J.D. 1996, "Linking technology and institutions: the innovation community framework", Research Policy, vol. 25, no. 1996, pp. 91-106.

Mehra, K. 2009, "Role of Intermediary Organisations in Innovation Systems - A Case from India", *The 6th Asialisc International Conference, Hong Kong*, ed. , National Institute of Science and Technology and Development Studies, New Delhi, 6-7 July 2009.

Mina, A., Connell, D. & Hughes, A. 2009, "Models of Technology Development in Intermediate Research Organisations", Working Paper, vol. Centre for Business Research, University of Cambridge, no. Working Paper No. 396, pp. Cambridge-UK.

Mowery, D.C., Oxley, J. & Silverman, B. 1996, “Strategic alliances and interfirm knowledge transfer”, Strategic Management Journal, vol. 17, no. 1, pp. 77-91.

Obstfeld, D. 2005, "Social Networks, the Tertius Iungens Orientation, and Involvement in Innovation", Administrative Science Quarterly, vol. 50, no. 1, pp. 100-130.

Oke, A., Idiagbon-Oke, M. & Walumbwa, F. 2008, "The relationship between brokers' influence, strength of ties and NPD project outcomes in innovation-driven horizontal networks", Journal of Operations Management, vol. 26, no. 2008, pp. 571-589.

Pitt, L., van der Merwe, R., Berthon, P., Salehi-Sangari, E. & Caruana, A. 2006, "Global alliance networks: A comparison of biotech SMEs in Sweden and Austria", Industrial Marketing Management, vol. 35, no. 2006, pp. 600-610.

Pontikakis, D., McDonnell, T. & Geoghegan, W. 2005[1], Conceptualising a National Innovation System: Actor Roles and Incentives, Working Paper Series CISC, No. 16, NUI Galway.

Pontikakis, D., McDonnell, T. & Geoghegan, W. 2005[2], Ireland's National Innovation System: An Exploratory Study of Supporting Institutions and Dynamic Actors, Working Paper Series CISC, No. 16, NUI, Galway.

Shohert, S. & Prevezer, M., 1996. “UK biotechnology: institutional linkages, technology transfer and the role of intermediaries”, R&D Management, vol. 26, pp. 283–298.

Stewart, J. & Hyysalo, S. 2008, "Intermediaries, Users and Social Learning in Technological Innovation", *International Journal of Innovation Management*, vol. 12, no. 3, pp. 295-325.

Thorgen, S., Wincent, J. & Ortqvist, D. 2009, "Designing interorganisational networks for innovation: An empirical examination of network configuration, formation and governance", Journal of Engineering and Technology Management, vol. 26, no. 2009, pp. 148-166.

van Lente, H., Hekkert, M., Smits, R. & van Waveren, B. 2003, "Roles of Systemic Intermediaries in Transition Processes", *International Journal of Innovation Management*, vol. 7, no. 3, pp. 247-279.

Watkins, D. & Horley, G., 1986. “Transferring technology from large to small firms: the role of intermediaries”. In: Webb, T., Quince, T., Watkins, D. (Eds.), Small Business Research. Gower, Aldershot, pp. 215–251.

Yusuf, S. 2008, "Intermediating knowledge exchange between universities and businesses", Research Policy, vol. 37, no. 2008, pp. 1167-1174.

Zeng, S.X., Xie, X.M. & Tam, C.M. 2010, "Relationship between cooperation networks and innovation pperformance of SMEs", Technovation, vol. 30, no. 2010, pp. 181-194.

Addressing System Problems: Development of an Innovation Broker

Christina Ryan[1, 2]

Teagasc Walsh Fellow
Email: christina.ryan@teagasc.ie

Supervisors: Dr Kevin Heanue [1], Dr Frank Devitt [2]

[1]Rural Economy and Development Programme, Teagasc, Athenry, Co. Galway
[2]Department of Design Innovation, National University of Ireland Maynooth, Co. Kildare

Key words: innovation broker, innovation system, mastitis control programme

Abstract

Mastitis imposes substantial costs on the Irish dairy sector. The problem affects farm and processor activities as well as the national reputation of Irish milk. Since October 2010 all milk produced and imported into the EU must come from farms with a cell count of less than 400,000 cells/ml. This limit can be used as an opportunity to deliver increased profits for Irish milk producers and processors through the production of higher value products and influence a positive effect on consumer perception of a safe product. One approach to tackling the problem is CellCheck - the national mastitis control programme which commenced in 2009. The goal of CellCheck is to enable the dairy industry sustain a national average bulk milk tank cell count of 200,000 cells/ml or under by 2020. The success of CellCheck rests on dairy industry stakeholders working together. The activities of CellCheck may be viewed as creating a problem-solving innovation system.

From an innovation system's perspective, coordination of interactions and learning among stakeholders are key to delivering innovation. An innovation broker is a type of intermediary concerned with brokering the formation and maintenance of an innovation system. Brokers are required in conditions where suboptimal levels of networking exists and where reforms are mediated by the context in which they are embedded (Madzudzo, 2011). There is ample evidence that an innovation broker can help with the initiation and operation of innovation networks by articulating the demand of clients, searching and linking actors for cooperation and guiding the subsequent innovation process (Batterink et al., 2010, Klerkx and Leeuwis, 2009, Klerkx et al., 2009). However, there are few examples in the literature of the process that is required to establish a broker in an innovation system. This research aims to address that gap in the literature by exploring the development of the broker role in CellCheck.

The methodology uses a case study approach. Non participatory observation of programme meetings, service provider training sessions and farm workshops is employed to follow the development of the programme and the complex path to delivering its objectives. Semi-

structured interviews are undertaken with eight newly appointed regional coordinators. The benefit is to study the real time development of an innovation broker with emphasis on how such a broker emerges and begins to operate in practice.

Early case study findings identify the design and functions of the regional coordinator in the innovation broker literature. Regional coordinators undertake the functions of demand stimulation, network formation and innovation process management from a visible, trustworthy position in the problem focused innovation system. However, the problems and challenges that regional coordinators need to address before they can commence activities may differ. One example of an activity of an innovation broker is to facilitate the formation of networks. Regional coordinators are responsible for organising partnerships amongst local service providers to facilitate the farm workshops. As regional coordinators operate from different contextual platforms, in relation to the resources available to them such as CellCheck trained service providers, commencement dates of workshops can vary significantly across regions. In order to meet CellCheck objectives, regional coordinators draw on their 'day to day' job experience and knowledge of the region to adapt advised activities. Based on the case study analysis, this research illustrates the various approaches which are undertaken by the individuals to operationalising their innovation broker role.

References

BATTERINK, M. H., WUBBENA, E. F. M., KLERKX, L. & OMTAA, S. W. F. O. (2010) Orchestrating innovation networks: The case of innovation brokers in the agri-food sector. *Entrepreneurship & Regional Development,* 22**,** 47-76.

KLERKX, L., HALL, A. & LEEUWIS, C. (2009) STRENGTHENING AGRICULTURAL INNOVATION CAPACITY: ARE INNOVATION BROKERS THE ANSWER? *UNU-MERIT Working Paper Series.* Maastricht, Maastricht Economic and social Research and training centre on Innovation and Technology, UNU-MERIT.

KLERKX, L. & LEEUWIS, C. (2009) Establishment and embedding of innovation brokers at different innovation system levels: Insights from Dutch agricultural sector. *Technology Analysis & Strategic Management,* 76**,** 849-860.

MADZUDZO, E. (2011) Role of Brokerage in Evolving Innovation Systems: A Case of the Fodder Innovation Project in Nigeria. *The Journal of Agricultural Education and Extension,* 17**,** 15.

Case Study: The Potential Economic Impact on Agriculture of Possible Freshwater Pearl Mussel Protection Strategies

Aksana Chyzheuskaya

NUI Galway and Teagasc Rural Economy and Development Programme

Supervisors: Cathal O'Donoghue, Stephen Hynes and Peter Howley
Teagasc Rural Economy and Development Programme

Abstract

This paper is an attempt to assign the cost to protecting an endangered species of the freshwater pearl mussel (FWPM) that are protected under the Habitats Directive (92/43/EEC), the Wildlife Acts (1976, amended 2000) and under the Water Framework Directive The natural habitat of the rivers has been used as an indicator of water quality and declining numbers of once abundant fresh water pearl mussel is one of the major concerns for Ireland. This mollusc is not only a very sensitive organism that signals the water pollution problem but is a unique species that has to be preserved for future generations. The fresh water pearl mussels need clean environment for living and reproduction.

Although the direct link is not established, the agricultural activities are often cited as contributing to the water pollution causing nutrient enrichment, eutrophication and siltation of the rivers where the FWPM populations are present.

Using Teagasc National Farm Survey data and Simulation Model of the Irish Local Economy (SMILE) data the cost of five mitigation measures that could reduce ecological pressure from the farms located in the pearl mussel catchments is simulated. The result of this study confirms the hypothesis that mitigation measures would lead to loss of income on the farms located in the catchments. Because it is unclear if any protective measures would result in the resumption of the FWPM recruitment, it is impossible to weight these costs against the benefits.