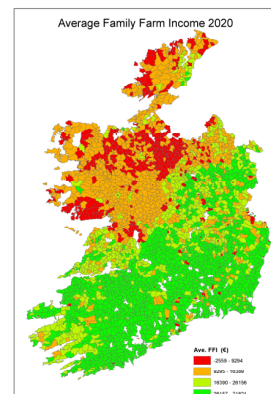**Project number:** 5572
Funding source: (NDP), BMW

Date: November, 2013
Project dates: Jan 2007 - May 2013

The rural development model: SMILE 2

Average Family Farm Income 2020

Key external stakeholders:
Government policy-makers, LEADER companies, regional assemblies, county and city councils, EPA.

Practical implications for stakeholders:
This project developed as a Spatial Microsimulation of the Irish Local Economy (SMILE) model, allows Teagasc researchers to examine a variety of policy questions, relevant to rural and regional development and environmental issues. The SMILE model is focused on the creation of a representative micro-level dataset that may be used to examine quality of life, health, poverty and the impact of agri-environmental schemes across Ireland.

- The SMILE model allows Teagasc researchers to apply a simulation methodology to a range of policy relevant areas of interest to the current and future policy agenda.
- The SMILE model will result in an increased capacity to examine the impact of rural and regional development policies ex-ante and ex-post on local communities. Thus, allowing scarce resources and policies to be targeted at the groups most likely to benefit from new policy intervention.

Main results:
- The first spatial microsimulation model that examines the Irish rural and regional economy was developed.
- A new calibration and validation technique for static spatial microsimulation was developed.
- A range of rural and regional policy areas that were previously under-researched in Ireland, due namely to data non-availability were examined.

Opportunity / Benefit:
This project was a developmental strategic project that developed modelling capacity that has subsequently been used as part of the inputs into Teagasc's involvement in spatial related policy reform such as the Commission for the Economic Development of Rural Areas and the Less Favoured Areas Value for Money Review.

Collaborating Institutions:
University of Leeds
NUI, Galway

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Teagasc project team: Karyn Morrissey (PI)
Cathal O'Donoghue
Stephen Hynes

External collaborators: Graham Clarke, University of Leeds
Dimitris Ballas, University of Sheffield

1. Project background:

The context of this project was to develop a policy impact assessment model for economic, social and policy issues that incorporate a spatial dimension. These include rural development and environmental issues. Currently available data and policy simulation models in Ireland do not allow for this. The model is thus a methodological improvement for use to analyse specific policy issues of relevance to rural Ireland. The model builds upon a previous RMIS project that developed a farm level spatial microsimulation model that did not have the capacity to analyse the wider rural economy issues.

The objective of this project is to develop a spatial microsimulation model developing current methods of matching different micro-datasets. Using these statistical techniques one can develop an attribute-rich spatial micro-dataset, thus allowing the development of various quality-of-life indicators at the spatial scale. The demographic structure produced by SMILE at the small area level (electoral division, ED) matches the CSO's Small Area Population Survey (SAPS) perfectly and incomes are consistent with CSO County Incomes and ESRI County Poverty Rates. Its' agricultural model replicates the spatial distribution of the Census of Agriculture and is consistent with the Teagasc National Farm Survey. It is thus an attribute-rich model that can be used for a variety of policy analyses.

SMILE is unique amongst spatial microsimulation models with the detail of its agricultural sector, combined with the Rural Economy sector, allowing the model to be used for agricultural and rural policy analysis. For example, the model has been used to assess the differential impact of the economic downturn on urban, rural and agricultural areas.

A new technique - static alignment - was developed and implemented to improve the data quality of SMILE. This technique was principally employed to the labour force and income level data produced by SMILE. Implementing this technique essentially means that SMILE now contains representative labour force and primary level income data at the ED level for the whole of Ireland. This means that SMILE may be used to produce quality-of-life measures for each individual in Ireland given their individual characteristics and spatial location.

A further extension to SMILE was a health component. Similar to the labour and income component, the health component has been validated to produce a realistic representation of the health status, both physical and mental of the Irish population. Thus, allowing policy-makers to examine the health profile of the Irish population across space. A further extension to SMILE has also been the use of spatial microsimulation to estimate aggregate consumer surplus values in environmental valuation studies. This allows analysis of rural and regional recreation and its' impact on the local economy.

2. Questions addressed by the project:

The project also had two analytical goals. The first was to develop the SMILE microsimulation framework. This involved developing an algorithm-based model that created representative population data for the whole of Ireland. A number of innovations were used in the development of the model, namely the static alignment technique used to validate the simulated data. The project thus had a large methodological component, so that the model would have a valid database on which to base policy analysis.

The second objective was to use the data created to examine a number of policy issues relevant to the sub-national level area (including districts within the BMW area, funded by the NDP), particularly in policy areas that were poorly represented before, due to data limitations. The SMILE model, once developed and validated, creates an attribute-rich spatial micro-dataset, thus allowing the development of various quality-of-life indicators at the sub-national scale. Work to date using data from the SMILE model has focused on poverty, inequality, agri-environmental impacts and health service provision and needs in rural areas.

3.   The experimental studies:

The objective of this research project was to develop a model capable of generating socio-economic data at the local area in Ireland.

Initial work involved choosing the correct algorithm and methodologies to create such a dataset. International cooperation from the University of Leeds was an important part of this initial work.

The second part of the project was to ensure that the data was validated and representative of the Irish population. A methodology new to the static spatial microsimulation model was developed. This allowed researchers to validate and calibrate the data of interest to ensure that the model outputs were representative of the Irish population. This essentially means that SMILE now contains representative labour force and primary level income data at the ED level for the whole of Ireland.

4.   Main results:

The main outcome of the project was a modelling system. A range of analyses were undertaken to test the effectiveness of the model. The principle outputs from the calibrated and validated SMILE model have been used to:

- Produce quality-of-life measures for each individual in Ireland given their individual characteristics and spatial location.
- Labour market and poverty analysis at the small area level in rural Ireland.
- Rural health service demand and provision.
- The impact of forestry recreation at the small area level.
- The impact of carbon taxes on family farm income.
- The willingness to pay for habitat conservation among Irish farmers.
- The spatial distribution of family farm income in rural Ireland.

5.   Opportunity/Benefit:

The primary stakeholder for this research is rural and regional policy-makers, the broad range of policy areas that one may examine, for example rural poverty, regional tourism, health service provision, means that the benefits of the project will be conferred to public stakeholders via the exploitation of these results through further research programmes and interaction with public stakeholders.

An indication of its impact is that stakeholders (Bord Bia and LEADER) have financed follow-on projects to use the model for Strategic Rural Development policy analysis and to help develop local sustainability indicators for the Irish beef sector.

6.   Dissemination:

The model has been used actively in policy research to produce submissions for government policy. A book and peer reviewed journal publications have been developed to disseminate to academics. A follow on project is transferring the methodology to partner institutions in the EU.

Main publications:

2 PhD thesis have used the SMILE Model.

7 journal publications using the results of the SMILE Model.

2 book chapters using the data from the SMILE Model.

14 International & National Conferences attended/presented at using data from SMILE.

Morrissey, Karyn, Clarke, Graham, Ballas, Dimitris, Hynes, S.P. and O'Donoghue, C. (2012). SMILE – An Applied Spatial Microsimulation Model for Ireland, (eds.) Stimson, R. and Haynes, K. *Geography and Geographers at Work*, Springer A3.

Morrissey, K., O'Donoghue C., (2011). The Spatial Distribution of Labour Force Participation and Market Earnings at the Sub-National Level in Ireland, *Review of Economic Analysis*, forthcoming A1.

Morrissey, Karyn, Hynes, Stephen, Clarke, Graham and O'Donoghue, Cathal (2010) 'Examining the factors associated with depression at the small area level in Ireland using spatial microsimulation techniques', *Irish Geography, 43: 1, 1 — 22 A1.*

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Morrissey, Karyn, Clarke, Graham, Ballas, Dimitris, Hynes, S.P. and O'Donoghue, C. (2008). Examining access to GP services in rural Ireland using microsimulation analysis. Area Vol. 40, No. 3, Pages 354-364 ISSN 0004-0894 17223 A1.

Morrissey K., G. Clarke and C. O'Donoghue, Accessibility Modelling: A Rural Health Care Application (2009), Christophe Mager and Francois Bavaud (EDs.), *Handbook of Theoretical and Quantitative Geography A3.*

Cullinan, J., Hynes, S.P. and O'Donoghue, C. (2008). Estimating catchment area population indicators using network analysis: an application to two small-scale forests in Co. Galway. *Irish Geography Vol 41*: *pp 279-294 ISSN 0075-0778 17557 A1.*

Hynes, S., Morrissey, K., O'Donoghue, C. and Clarke, G. (2009). Building a Static Farm Level Spatial Microsimulation Model for Rural Development and Agricultural Policy Analysis in Ireland. *International Journal of Agricultural Resources, Governance and Ecology, 8 (3): 282-299.*

Hynes, S., Morrissey, K., O'Donoghue, C. and Clarke, G. (2009). A Spatial Microsimulation Analysis of Methane Emissions from Irish Agriculture. *Journal of Ecological Complexity 6: 135– 146.*

Hynes, S., Farrelly, N., Murphy, E. and O'Donoghue, C. (2008). Modelling habitat conservation and participation in agri-environmental schemes: A spatial microsimulation approach. *Ecological Economics*, *vol. 66, issue 2-3, pages 258-269.*

Morrissey K., (2008) Access to Health Care Services in Rural Ireland, Unpublished PhD Thesis.

Cullinane, J. (2009) Recreational Modelling, Unpublished PhD Thesis.

Cullinan, J., Hynes, S.P. and O'Donoghue, C. (2008). Using spatial microsimulation to estimate aggregate consumer surplus values in travel cost modelling. In: 16th Annual meeting of the European association of environmental and natural resource economists, Gothenburg, Sweden, 25-Jun-2008, *** 17572.

Morrissey, K., Clarke, G.P., and O'Donoghue, C., 2008 'The Spatial Pattern of Ill-Health and Health Service Utilisation in Ireland, European Regional Science Association, Liverpool, England, 27th – 31st of August 2008.

Morrissey, K., Clarke, G.P., Hynes, S., Ballas, D., and O'Donoghue, C., (2007). 'Access to GP Services in Rural Ireland', ECTQG, Montreux, Switzerland, 7th – 13th of September 2007.

Morrissey, K., Clarke, G.P., Hynes, S., Ballas, D., and O'Donoghue, C., (2007). 'Access to Acute Hospital Services in Rural Ireland', Geocomputation, Maynooth, Ireland, 1st – 3rd of September 2007.

Morrissey, K., Clarke, G.P., Hynes, S., Ballas, D., and O'Donoghue, C., (2007). 'Spatial Microsimulation for Rural Policy Analysis in Ireland: SMILE & it's Applications', European Regional Science Association, Paris, France, 27th – 31st of August 2007.

Morrissey, K., Clarke, G.P., Hynes, S., Ballas, D., and O'Donoghue, C., (2007). 'Access to GP Services in Rural Ireland: Spatial Microsimulation, an application', International Microsimulation Association, Vienna, Austria, 20th – 22nd of August 2007.

Morrissey, K., Clarke, G.P., Hynes, S., Ballas, D., and O'Donoghue, C., (2007). 'Spatial Microsimulation for Rural Policy Analysis in Ireland: SMILE the story to date', RuraLearn Conference, Chios, Greece, 23rd – 25th of June, 2007.

Morrissey K. and Heanue K. (2007). 'Rural Services Research at the Rural Economy Research Centre, Teagasc', Irish Rural Link Conference, 22nd of May, 2008.

7.   Compiled by: Karyn Morrissey, John Cullinan, Cathal O'Donoghue, Stephen Hynes, John Lennon.

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