European Network for Rural Development

TWG2 – Linkages between agriculture and the wider rural economy

Selection of regions and initial I/O analysis results

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Connecting Rural Europe

THEMATIC WORKING GROUP No 2

LINKAGES BETWEEN AGRICULTURE AND THE WIDER RURAL ECONOMY

Thematic Working Group (TWG) started its activity in March 2009.

The activities of the working group have aimed at identifying and describing the relationships and potential synergies and/or conflicts between agriculture and the rural economy in various types of EU rural areas. This work has involved:

- developing a better understanding of the economic relationships between agriculture and rural economy at the local level, including the multifunctional contribution of agriculture;
- identifying the key factors that determine the potential of regions and localities – economic, human resource, natural endowment, competition over resources – and classifying those where policy support can be most effective;
- screening policy programmes at national, regional and local level in order to assess their coherence and consistency regarding agriculture and rural development;
- assessing the contribution of current policies and institutional arrangements to successful outcomes – positive aspects, difficulties and obstacles;
- presenting the main findings that could be relevant for the development of current and future policy on agriculture and rural development.

The focus is on the current programming period (2007-2013), while taking account of relevant previous programming experience. Primary attention is given to EU Rural Development support (EAFRD) nevertheless the significance of other EU funded programmes, national, regional and local programmes and other private funding sources is also taken into account.

The activity of the group was undertaken in 4 steps.

Step 1 involved the *selection of a set of 18 NUTS3 level rural areas* from across the EU, designed to ensure as representative and comprehensive as possible coverage of various types of rural areas, including those with various levels of agricultural activity and development, as well as differences in location, geography and economic development.

Step 2 involved a study of *how agriculture contributes to the way rural economies work* through three separate, but coordinated, activities: comparisons of the available economic and social data on structures and trends for the selected NUTS3 regions; input-output analyses of the relationship between agriculture and other sectors within the local regions; the collection of more qualitative data about such factors as the nature and capacity of the regions under analysis through questionnaire-based surveys undertaken by national experts.

Steps 3 and 4 involved an the in-depth investigation of six of the 18 selected regions, particularly focused on the importance of the impact of various institutional and financial factors in enhancing or inhibiting the potential for local agriculture to assist and support economic development in the region.

An important part of this phase of the analysis has been the identification of relevant projects (when possible from the current programming period) that can demonstrate the synergies achieved between agriculture and the wider rural economy and how current RDP measures (and possibly other funding sources) have been able to promote and enhance such linkages. The case studies have been used to support the recommendations made in the final report and also to form part of the "EN RD project Database".

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1 Introduction

In accordance to the specification of the Thematic Working Group 2, the general objective of this working group is to identify and describe the relationships and potential synergies/conflicts between agriculture and the wider rural economy in various types of rural territories (such as remote, intermediate and peri-urban rural areas).

Step 1 of the TWG 2 workplan aims at the investigation of links between agriculture and the rest of the rural economy in terms of:

i. use of farm output in the rest of the economy;
ii. provision of non-agricultural goods and services to the farm sector;
iii. supply and demand for production factors, and
iv. potential for diversification of farm activities.

In more detail, the aim of Step 1 is to:

- to examine the current situation related to the synergy and interdependence between agriculture and the rest of the rural economy in representative rural regions in the EU; these regions will be preliminary classified according to several criteria including the relative importance of agriculture (which will constitute a major criterion);
- to investigate the construction of a typology of regions on the basis of the findings of the above analysis.

Within this context, the first two Tasks (1.1 and 1.2) of Step 1 aim at the investigation of linkages between agriculture and the rest of the rural economy and at the preliminary identification of a typology of regions. Specifically, these aims can be broken into the following sub-tasks:

1. the systematic analysis of data for the selection of representative regions; this analysis will be based on criteria which reflect the degree of importance of agriculture in relation to the importance of other major rural industries (such as food processing and tourism), demographic evolution, structural/physical characteristics (e.g. mountainous area) and competition for natural resources (land, water).
2. the application of the Regional Input-Output (I/O) methodology in order to assess synergy and interdependence between agriculture and the wider rural economy. Inter-relationships to be investigated include the use of farm output in the rest of the economy, the provision of inputs to the agricultural sector, the links between agriculture and production factors and the potential for diversification of farm activities. These inter-relationships will be investigated through the estimation and analysis of indicators of economic interdependence.
3. the utilization of the indicator analysis in order to identify different patterns of interdependence in the selected study areas.
4. the specification of a preliminary typology of EU rural regions, based on the findings of sub-task 3 (above).

Significant linkages identified (sub-task 3) will be further investigated in the context of Step 2 of TWG 2. In more detail, there will be an investigation (test of hypothesis) of the degree of correlation between different patterns and key factors related to different degrees of interdependence between agriculture and the wider rural economy and additional study-region-specific characteristics (such as e.g. agricultural specialization, innovation in food processing, etc.). This analysis will lead (through amongst others, a possible modification of IO models) to a re-run of the structural IO analysis and ultimately, to a revision of the preliminary typology of EU rural regions.

Taking the above into account, this report is structured as follows: section 2 presents analytically the I/O methodological framework including its regional and environmental application (ecological commodities model) which will be utilized for the estimation of the links between agricultural and non-agricultural sectors, water and land. Section 3 presents several alternative indicators capturing the nature and strength of inter-industry linkages and links between economic activity and production factors. Section 4 concentrates on the application of the I/O methodology to the test regions. It first presents the process utilized for selecting 18 test regions; then there is a presentation of the model construction process (procedure, data requirements). Subsequently, Section 5 presents the interdependence analysis results in a comparative manner (i.e. comparison between and within the specified cluster groups). The presentation of interdependence analysis results will be structured according to the four categories of links between agriculture and the rest of the economy specified in the work plan (see also above). Then, the last Section of the report will present a preliminary typology of EU rural regions, based on the findings of the interdependence analysis.

2 Methodology: The I/O Analytical Framework

2.1 Input-Output Analysis

2.1.1 Introduction

Input-Output (I/O) analysis is 'an adaptation of the neoclassical theory of general equilibrium to the empirical study of the quantitative interdependence between interrelated economic activities' (Leontief, 1953). It is a quantitative technique for studying the interdependence of the producing and consuming units within an economy. An I/O table identifies the major industries in an economy and the financial flows between them over a stated time period (usually a year). It indicates the sources of each sector's inputs, which are purchased from the same or other sectors in the economy, imported, or earned by labour (household's wages and salaries). It also provides a breakdown for each sector's output, which can be sales to other industries and to final demand (household consumption, government consumption, capital formation, and exports). The interdependence between the individual sectors of the given economy is normally described by a set of linear equations, representing fixed shares of input in the production of each output.

By disaggregating the total economy into a number of interacting sectors, I/O analysis provides an impressive tool for sectoral investigations. Within a macroeconomic framework, it creates a basis for the evaluation of the impact of policies with respect to national or regional goals such as GNP, employment and the balance of trade. Also, I/O analysis provides more general information compared to a partial equilibrium model which concentrates on one sector, and more disaggregated information compared to a purely macroeconomic model.

An I/O model can be used for structural analysis, technical change analysis and forecasting. However, the most popular application of the I/O technique is impact analysis, where the model is used to estimate direct and indirect effects on related sectors and on the whole economy resulting from increased demand for the output of one (single-sector analysis) or more sectors. These effects are measured as changes in output, income and employment, and are reflected in sectoral multipliers. Impact information is available in disaggregated as well as total form, and policy makers can be provided with information on which industries or sectors are impacted by such increase(s) in final demand and by how much. In this way, I/O becomes a particularly useful technique in a national/regional development planning context.

In this part, there is first a description of the transactions table which constitutes the basis of the I/O model. Then, the transformation of the transactions table to an economic model is presented. This is followed by a description of the concept of I/O multipliers.

2.1.2 The Input-Output Transactions Table

The basic table of the I/O system is called the 'Transactions Table' (Figure 1). This Table identifies in monetary terms the economic flows within the economy during a base year. More important, it indicates the various sectors (classified according to the type of economic activity) and traces out the value of transactions related to them (inter-industry linkages). The number of sectors recorded in the transactions table depends on data availability, as well as on the objectives of the study. The output of each sector is distributed along the respective row in the table, while each column indicates the value of inputs absorbed in the production process. The transactions are valued either at prices paid by purchasers or at prices received by producers, implying differences associated with transport, distribution, and service margins, as well as the imposition of taxes on expenditure less subsidies which are added to the original selling price of the good. The Transactions Table is a systematic way of representing Social Accounts in an economy but also provides information on the economic structure which is not available in traditional National Accounts.

The table can be divided into four quadrants. The top left-hand quadrant, termed the 'intermediate' quadrant, shows the flows of goods and services which are both produced and consumed in the process of current production. It contains all inter-industry transactions, or production relationships, in the economy; thus wij represents a sale from sector *i* to sector *j*. The top right-hand part of the table describes consumer behaviour, identifying all sales which are not absorbed as intermediate product by the domestic industries, but are directed towards final demand. Final demand can be distinguished into domestic and foreign. Domestic final demand is composed from household consumption, capital formation, government purchases and changes in stocks, while foreign final demand from exports; thus fil represents a sale of industry *i* to the final demand *l*. The bottom-left quadrant records primary inputs (i.e. inputs not purchased from domestic sectors) purchased by any sector in the economy. These inputs are not part of current production; they include imports, wages, profits, taxes, and subsidies; therefore pkj represents the purchase of a primary input k by sector j. Finally, the bottom-right quadrant indicates 'direct transfers', or inputs directed to final demand, such as imports by households and investors.
An essential feature of the intermediate quadrant is that it must be a square matrix (O'Connor and Henry, 1975). It contains all activities of the economy which are determined within the system; these activities are termed as endogenous. All exogenous elements (i.e. exports, capital expenditure, government spending, etc.) related to the economy under study (i.e. sectors 'externally' influenced) are included in the final demand, primary inputs, and direct transfers quadrants, respectively. These exogenous elements are assumed to be autonomously determined by factors outside the I/O system.

Figure 1: A Schematic Input-Output Transactions Table

Sales by:	*Purchases by Sector:* 1 2 ... n	*Final Demand (Y)* 1 ... m	*Gross Output*
Sector: 1 2 n	w11 w12 w1n w21 w22 w2n wn1 wn2 wnn	f11 f1m f21 f2m fn1 fnm	x1 x2 xn
Primary 1 *Inputs* : h	p11 p12 p1n ph1 ph2 phn		pt1 pth
Gross Input	x1 x2 xn	ft1 ftm	

Households can be treated as either an exogenous or an endogenous element in the I/O system, as changes in outputs are associated with changes in wages and in household consumption. In the latter case, it is assumed that households constitute an industry whose output is labour and whose inputs are consumption goods; household income is spent within the system, generating therefore further economic activity. Thus the column of consumer expenditure indicates the structure of the households' consumption distributed among sectors, while the row of wages and salaries indicates their 'inflows' (i.e. wages and salaries). If households are treated as endogenous in an I/O system, the model is termed as 'closed with respect to households' or 'consumption-induced'.

2.1.3 The Economic Model

The transactions table can be expressed as an economic model based on 'identities, technical conditions and equilibrium conditions' (Schaffer, 1976). The objective of this transformation is the identification of:

(a) the sectors with the most favourable prospects for development, and

(b) the sectors of which the development would significantly contribute to the economic development of the economy under study.

Thus, transactions table entries can be defined in terms of the following balance equation:

$$X_i = w_{i1} + w_{i2} + \ldots + w_{in} + f_{i1} + \ldots + f_{im} \quad (i = 1, 2, \ldots, n) \quad (1)$$

The above equation indicates an accounting identity between total output sales of sector *i* and the sales of *i* to intermediate sectors (transactions in the endogenous part of the table) and to final demand (exogenous part of the table).

The next step in the modelling process is the introduction of technical conditions. These are expressed in the form of 'technical coefficients' or 'direct requirements coefficients' derived by dividing the elements of the transactions table columns by the respective column total. These coefficients show the 'first round' effects of a change in the output of one industry on the industries from which it purchases inputs. They indicate the unit cost structure in the production process (O'Connor and Henry, 1975). In general terms, they are denoted as:

$$a_{ij} = w_{ij} / X_j \quad (2)$$

Therefore equation (1) can be expressed as:

$$X_i = a_{i1}X_1 + a_{i2}X_2 + \ldots + a_{in}X_n + f_{i1} + \ldots + f_{im} \quad (i = 1, 2, \ldots, n) \quad (3)$$

In matrix form, this can be represented as:

$$\mathbf{X} = \mathbf{AX} + \mathbf{Y} \quad (4)$$

where **X** = an column vector of gross outputs

A = the technical coefficients square matrix , and

Y = a column vector of total final demands.

Equation (4) can be re-expressed as:

$$\mathbf{X}\,(\mathbf{I} - \mathbf{A}) = \mathbf{Y} \quad (5)$$

where (I - A) is termed the 'Leontief matrix', and

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1}\,\mathbf{Y} \quad (6)$$

The 'Leontief inverse' is:

$$\mathbf{B} = (\mathbf{I} - \mathbf{A})^{-1} = [\,b_{ij}\,] \quad (7)$$

The elements of **B**, bij, are termed 'interdependence coefficients' and indicate the direct and indirect effects in the output of industry *i* necessary to accommodate a one unit of value increase of the final demand for the product of industry *j*. Therefore, the 'Leontief inverse' matrix can trace the impacts/consequences (in the form of projections of changes in gross output) of a change in the final demand, via:

$$\Delta \mathbf{X} = (\mathbf{I} - \mathbf{A})\text{-}\mathbf{1} \quad \Delta \mathbf{Y} \qquad (8)$$

- *(d) Multipliers*

A multiplier can be defined as a measure of response to an economic stimulus. Multipliers measure '...the total impact upon employment, income, and output resulting from a given change in investment' (Miernyk, 1969). The main feature of the I/O technique is the study of the interdependency of sectors within the economy; therefore, I/O is an ideal means for the estimation of disaggregated sectoral multipliers. In this context, the increase in final demand for the product of a sector by one unit, creates three major effects on output, income and employment. These are:

a) the direct effect, which represents the immediate output, income and employment effects on sector j, caused by a unit increase in final demand for the output of sector j;

b) the indirect effect, which reflects the 'second and subsequent-round' output, income, and employment effects on the economy (i.e. on sector j and its input-providing sectors), caused by a unit increase in final demand for the output of sector j;

c) the induced (or consumption-induced) effect, which represents the output, income, and employment effects on the economy, induced by household spending of income generated in the production process, as a result of a unit increase in final demand for the output of sector j.

Consequently, Type I and Type II multipliers can be calculated as (Miernyk, 1969; Richardson, 1972):

Direct and Indirect Effect

Type I multiplier = --------------------------

Direct Effects

Direct, Indirect, and Induced Effects

Type II multiplier = -------------------------------------

Direct Effects

The ability to disaggregate the effects of a stimulus in economic activity is a significant feature of multiplier analysis in an I/O context, as it can accommodate comparisons between the components of the total impact.

Output Multipliers

In an I/O table, the matrix of interdependence coefficients (Inverse Leontief Matrix), **B**, is the key element to multiplier analysis, as it indicates the pattern of inter-industry linkages. The coefficients bij (which are in fact sectoral output multipliers) indicate the direct and indirect effects on the output of each sector i, caused by a unit increase in the final demand for the output of sector j. The Type I output multiplier for sector j can be calculated by summing the elements in the columns of B and is defined as:

Type I output multiplier for sector j = $\sum_{i=1}^{n} b_{ij}$ (9)

When the model is closed with respect to households, the induced effects of the increased household spending can be calculated by summing the columns of the B* matrix, where B* is the B matrix enlarged by the income from employment row and the household consumption column:

Type II output multiplier for sector j = $\sum_{i=1}^{n} b*_{ij}$ (10)

where b*ij are the elements of the B* matrix.

Income Multipliers

Income multipliers measure the increase in incomes in the economy associated with a unit increase in final demand for the output of sector j. The direct effect of unit increases in final demand for output on income (direct income coefficient) is indicated by the ratio of employment income to sectoral output (i.e. technical coefficient):

DICj = Lj/Xj (11)

where Lj is income from employment in sector j and Xj is output of sector j.

The direct and indirect income change is derived by multiplying each column element of the inverse Leontief matrix Z by the supplying industry's corresponding household row coefficient. Then, the direct and indirect income coefficient (DIIC) may be calculated as:

DIICj = $\sum_{i=1}^{n} b_{ij} DIC_i$ (12)

The indirect income effect is calculated as:

Indirect income effect = DIICj - DICj (13)

Type I income multipliers are defined as the ratio of direct and indirect to direct income effects resulting from a unit increase in final demand for the output of sector j:

Type I income multiplier j = DIICj/DICj (14)

A Type I income multiplier for sector j indicates the indirect income generated by an increase in the sector's output relative to the direct income generated.

The direct, indirect, and induced income coefficient (DIIIC) takes into account income expansion generated by increased consumer spending arising from the direct and indirect increases in output and thus household incomes. The coefficient is obtained from the "income from employment" row of the expanded (closed to households) inverse Leontief matrix B*:

DIIICj = b*ij (15)

where b*ij is the set of the "income from employment" row elements.

Type II income multipliers are defined as the ratio of direct, indirect and induced income change to direct income change, resulting from a unit increase in final demand for the output of sector j:

Type II income multiplier j = DIIICj/DICj (16)

A Type II income multiplier for sector j indicates the indirect and induced income generated by an increase in the sector's output relative to the direct income generated.

Employment Multipliers

Employment multipliers measure the effects upon employment in the economy, associated with a unit increase in final demand for the output of sector j. The direct effect of a change in output in sector j on employment in sector j (direct employment coefficient) can be calculated as:

DECj = Ej/Xj (17)

where Ej is employment in sector j and Xj is output in sector j.

The direct and indirect effects on employment (direct and indirect employment coefficient) are derived in similar fashion to the direct and indirect income effects:

$$DIEC = \sum_{i=1}^{n} b_{ij} DEC_i \quad (18)$$

Indirect employment effect = DIECj - DECj (19)

Type I employment multiplier j = DIECj/DECj (20)

The direct, indirect, and induced employment coefficient:

$$DIIEC = \sum_{i=1}^{n} b*ijDEC_i \quad (21)$$

Type II Employment Multiplier j = DIIECj/DECj (22)

2.2 Regional I/O Models

2.2.1 A Retrospective View

Originally, I/O models were estimated at the national level, though sectors may show considerable spatial variation in their I/O patterns. The consequences of certain economic events for specific rural regions or zones are important for rural economic models, and thus, I/O tables have been created also for smaller areas in order to facilitate the analysis of their structure, and enable the estimation of the impacts of exogenous shocks on a local economy.

There are two basic features of a regional economy that influence the characteristics of a regional I/O model (Richardson, 1972; Miller and Blair, 1985). First, due to the economics of location and the comparative advantage, regional production structure can be identical to or it may differ markedly from that recorded at the national level. Second, the regional economy is typically much more open than the national economy, as there is more specialization and exchange among regions. Generally, the smaller the economic area under question, the more dependent its economy is, on exports and imports. That is, the trade sector is much more dominant in determining the level and structure of economic activity within the region.

In this context, the I/O method has been applied in two distinct ways at the regional level: as a framework for the formulation of single-region models and in an extended form that provides a multiregional dimension in a single model. Single-region models represent one approach to modelling a regional economy in I/O terms. One of the acknowledged weaknesses of these models is that they view the regional economy in isolation, thereby ignoring interdependencies across boundaries (Miller, 1969). That is, the one region of interest is disconnected from the rest of the country within which, is located. This is surely a shortcoming, as new exogenous demand associated with the region under study, will surely have ramifications in other regions as well. The only alternative to surpass the above problem is to attempt to construct many-region (interregional and multiregional) models capable to capture the important kinds of interregional linkages, as well as the regional aspects of production.

Seminal work on regional and interregional models has been published by Isard (1951) and Leontief (1953). Isard's interregional system has been called "the pure interregional model", while Leontief's model is known as "the balanced model". The former is constructed by developing a set of regional tables. The latter is constructed by disaggregating a national table into a set of component regions. The balanced regional model is particularly useful for determining regional implications of national projections, while the pure interregional model for determining national implications of regional projections.

Since the 1950s, I/O models at the regional level have been extensively employed in applied work to investigate a wide range of regional issues including policy-impact analysis (indicatively see, Moore and Petersen, 1955; Schaffer and Chu, 1969; Hewings, 1969; Mattas *et al.*, 1984; Gould and Kulshreshtha, 1986; Johns and Leat, 1987; Mattas and Shrestha, 1991; Psaltopoulos and Thomson, 1993; Gilchrist and St. Louis, 1994).

The first efforts to construct interregional input-output (IRIO) tables were made by Chenery *et al.* (1953) and Moses (1955). Their contributions were more conceptual than empirical, although they demonstrated that it is possible, in principle, to estimate the impacts of changes that take place in one region on the others. Probably, the most ambitious attempt to implement the IRIO model in a real-world situation is the series of Japanese survey-based interregional tables beginning with 1960 and updated every five years (Japanese Government, 1964, 1969, 1974). Also, there has been work in the Netherlands on the construction of a Dutch three-region interregional model (Oosterhaven, 1981).[1]

Leontief and Strout (1963) developed a multiregional model which allowed for interregional trade transactions, and identified interregional commodity flows from a set of structural equations (without collecting data), something earlier interregional models were unable to do (Polenske, 1972; Rodgers, 1973). A major effort, extending over several years, was made by Polenske (1980), to construct an operational multiregional I/O (MRIO) model, which accounts for 51 regions and 79 sectors in each region and a high degree of intraregional disaggregation.

The main difficulty with constructing regional I/O models is that data on inter-sectoral flows between sectors and regions are not readily available. So far, a number of relatively complex proxies have been introduced to estimate this information, broadly categorized as survey, non-survey and hybrid (Richardson, 1972).[2]

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[1] More recent applications of the interregional models can be found in Stelder *et al.* (2000), Sonis *et al.* (2000), Verduras (2000).

[2] A review of these techniques is provided among others in Sawyer and Miller (1983) and Karunarante (1989).

After this brief presentation of different types of regional I/O models, the next sections deal with a detailed description of one of the most used hybrid approaches for constructing regional I/O tables, the Generation of Regional Input Output Tables (GRIT) technique, as well as with its extensions. In fact, for reasons described below, GRIT is utilized as a regionalization technique for the regional I/O models to be constructed and tested in this work.

2.2.2 The "Generation of Regional Input Output Tables" (GRIT) Technique

The First GRIT Approach

The fact that survey-based regional I/O models were too expensive and time-consuming to construct, while purely mechanical non-survey models did not produce satisfactory results, led to the suggestion that hybrid approaches were the future of regional I/O analysis (Richardson, 1972). Broadly, these methods utilize region-specific information that is not likely to be generally available, except through survey, but here, the level of survey-detail is much less than it would be required for a survey-based full inter-sectoral flows matrix.

Probably the most advanced of these techniques is the GRIT technique originally developed by Jensen *et al.* (1979). The authors applied the GRIT (currently termed GRIT I) method on the production of I/O tables for the region of Queensland, Australia, from both national I/O tables and other sources. The approach was based on a combination of non-survey methods (e.g., location quotients), but allowed modifications of mechanically produced tables at the discretion of the analyst, to produce more realistic regional tables and coefficients (West, 1981).[3]

A special aspect of GRIT is the use of "superior data" where appropriate. This means that after the SLQ procedure has been applied as a method of adjusting the national table, the analyst has the opportunity to incorporate regional data, which is superior in quality compared to that in the existing table. For example, there might be primary data to suggest that a coefficient in the regionally adjusted table has been substantially over- or under-estimated, in which case, superior data substitutes the initial mechanically-derived estimate. These superior estimates may come from surveys, other primary data sources, or reliable secondary data (Richardson, 1985).

The concept of accuracy embodied in GRIT implies "freedom from significant error" through the introduction of "superior data", where this can be obtained and by the retention of facilities for the analyst to exercise his/her judgment in the formation of the final tables.[4] This implies a holistic concept of accuracy, i.e., that the table presents a representative overall picture of the regional economies concerned. Such a concept creates difficulties in the

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[3] The GRIT technique, as originally developed by Jensen *et al.* (1979), utilized the Simple Location Quotient (SLQ) as method of coefficient reduction. The quotient itself compares the relative importance of a sector regionally to its relative importance in the nation. A potential drawback of SLQ approach is that only the size of the selling sector is taken into account, although clearly, the relative size of the purchasing sector may also be of crucial importance in determining the extent of regional imports. The use of the Cross-Industry Location Quotient (CILQ), proposed by Johns and Leat (1987), helps to overcome this problem, by taking into consideration the relative local importance of the purchasing sector as well as of the selling sector.

[4] For a comprehensive discussion on the concept of accuracy in regional input-output, see Jensen (1979) and Jensen *et al.* (1979).

measurement of accuracy, since the concern is with the internal structure of the matrix and identifiable principal components. One measure, which is relevant, lies in the comparison of multipliers derived from GRIT with those derived from survey-based tables. Such comparisons were made and allowed Jensen *et al.* (1979) to conclude that either freedom from significant "error" had been achieved, or both sets of tables were subject to the same relative errors.

GRIT was designed for application either to single ad hoc regions, or to a system of regions, such as a state or nation. In more specific terms, the features of the GRIT system are:

a) I/O tables with their attendant multipliers can be calculated for any region for which certain minimum levels of data are available.

b) If GRIT is applied to a system of regions, the regional tables will be consistent with the table of the economy as a whole, i.e. the state or nation.

c) The GRIT methodology is a combination of selected non-survey and survey procedures. At various stages of the procedure, facilities exist, which allow insertion of superior data at the discretion of the analyst.

d) In the first instance, the system relies on the availability of a national table and of data reflecting regional levels (i.e. output and employment). As these sources are replaced by more recent figures, they may replace the original data, and generate an updated table, with a minimum of effort.

e) The I/O tables and multipliers derived for the state economy and for each of the component regions are directly comparable. In terms of sector definition, in terms of accounting procedures and conceptual definition, each regional table is consistent with the other regional tables and with the table of the "total" economy.

f) The application of the system in an empirical context will involve limited expense in terms of money and time, consistent with an apparently reasonable degree of accuracy.

g) The application of the system is sufficiently uncomplicated, to encourage use by analysts without a high level of expertise in the preparation of conventional survey-based tables.

h) GRIT proceeds in a number of clearly defined phases, each with modular components. It is likely that other analysts may prefer a different combination of procedural components to that comprising in the basic GRIT system. In this event, an individual module could be replaced by one preferred by the analyst.

There has been considerable work on regional I/O modelling, using GRIT. West *et al.* (1979; 1980) applied the GRIT methodology to develop regional tables for South Australia and the Northern Territory. Two applications have been undertaken in New Zealand – one for deriving a simplified I/O table for Otago region (Hubbard and Brown, 1979), and the other for assessing the regional impacts of the Tiwai Point Aluminium Smelter on the Southland economy (Brown, 1980). Johns and Leat (1987) constructed an I/O model using GRIT, to estimate regional technical coefficients for the Grampian region in Scotland. More recently, Psaltopoulos and Thomson (1993) and Ciobanu *et al.* (2004) investigated the structural changes in the regional economy of East Macedonia and Thrace.

The GRIT methodology comprises of fifteen steps, which are arranged in five phases (Jensen *et al.*, 1979) and enable the user to derive standardized non-survey regional tables from a national table of one form or another (see Table 1). A brief description of the GRIT methodological sequence follows below.

Phase I of the sequence provides for adjustments to the national table, which supplies the basic input into GRIT; these comprise adjustments for price changes, updating and international trade.

In Phase II, regional imports for each region for which tables are constructed, are estimated. This is carried out by assuming that national sectoral coefficients, which refer to sectors which do not exist in the region, indicate the level of regional non-competitive imports. Further, some of the coefficients of sectors, which exist in the region, are adjusted downwards to eliminate that proportion of purchases attributed to these sectors in the national table, which in fact, become imports at the regional level.

Table 1: The GRIT methodological sequence

Phase I Adjustments to national table	
1	Start with national I/O table
2	Adjustment of national table for price levels and updating
3	Adjustment for international trade
Phase II Adjustment for regional imports	
4	Calculation of non-competitive imports
5	Calculation of competitive imports
Phase III Definition of regional sectors	
6	Insertion of disaggregated superior data
7	Aggregation of sectors
	Insertion of aggregated superior data
Phase IV Derivation of prototype transactions tables	
9	Derivation of initial transactions tables
10	Manual or iterative adjustments to initial tables to derive prototype tables
11	Aggregation, if uniform tables are required
12	Derivation of inverses and multipliers for prototype tables
Phase V Derivation of final transactions tables	
13	Insertion of final superior data and other adjustments
14	Derivation of final transactions tables
15	Derivation of inverses and multipliers for final tables

Phase III provides for the insertion of "disaggregated superior data", i.e. estimates which the analyst considers superior to those produced by the mechanical operations of Phases I and II, and which were available at the disaggregated level. Adjustments are also made for region-unique industrial mix and production functions by weighted aggregation to smaller (in terms of sectoral aggregation) tables, which are more indicative of the simpler economic structure of regions. Phase II and III, then, attempt adjustments for the main differences between a national and corresponding regional sector, namely the level of imports, the component industry mix and the production functions.

Phase IV provides a further opportunity for the insertion of superior data, when these data are available only in a more aggregated form. From the coefficients developed from earlier phases, an initial regional transactions table is developed by applying regional output estimates to the coefficients, to produce first estimates of transactions. Either manual or constrained-matrix iterative adjustments are applied to produce a consistent prototype transactions table.

Finally, Phase V allows for the inspection of each table, the insertion of more superior data and other adjustments, to improve the accuracy of the table or to remove discrepancies. This phase produces final transactions tables and associated multipliers.

The GRIT II Approach

In 1980, the original GRIT procedure was reviewed, and a GRIT II method was developed (West *et al.*, 1980). Compared to the original GRIT system and in order to make the procedure more efficient, GRIT II incorporates three major modifications as follows:

Modifications to the Simple Location Quotient (SLQ)

The location quotient was adjusted to account for regional differences in labour productivity, household consumption and exports. It appears that the modified SLQ gives a more accurate measure of regional trade coefficients, in regions which are relatively more distant from the national "average". The greater the difference between the region and the nation, the less satisfactory is the SLQ. Empirical testing of the various SLQs showed that the modified SLQ produces more realistic coefficients than the other "less modified" SLQs.[5]

Accuracy optimization

The construction of regional I/O tables within limited resources available in terms of finance and time, makes virtually impossible to apply close scrutiny and also obtain superior data for all the coefficients in the prototype table. In addition, it would be very difficult to justify such a procedure in terms of cost-benefit considerations. Analysts would agree that some sections of the table are more "critical" than others. In the application stage, if the analyst is interested in particular sectors, he/she should give these sectors, together with other strongly inter-related sectors, close scrutiny before proceeding with the impact analysis. Therefore if the analyst can rank coefficients in terms of their relative importance (in terms of the magnitude of errors that they affect on the final multipliers), he/she can get some idea as to

[5] The modified SLQ is defined for sector i as: $SLQ_i^M = SLQ_i^E * \frac{\theta}{\theta_i} * \frac{C}{C_i}$ where SLQ_i^M is the modified SLQ; $SLQ_i^E = (E_i^R / E^R)/(E_i^N / E^N)$ is the simple employment location quotient (E refers to employment and the superscripts R and N denote region and nation, respectively); $\theta = (E^R / X^R)/(E^N / X^N)$ is the productivity ratio of the region relative to the nation (X refers to output) and $\theta_i = (E_i^R / X_i^R)/(E_i^N / X_i^N)$ is the productivity ratio for the corresponding regional and national sectors; $C = C^R / C^N$ is the consumption ratio for the region relative to the nation and $C = C_i^R / C_i^N$ is the consumption ratio between corresponding regional and national sectors.

which coefficients and sectors should concentrate on, in order to minimize the final multiplier errors, subject to the resources available.

West *et al.* (1979, 1980) have shown that there is a simple mathematical relationship between coefficient and multiplier error. This relationship allows to rank coefficients in order of their importance (with respect to errors affecting the multiplier values), subject to a wide range of criteria from which the analyst can choose.

Accuracy in I/O can be bisected into two broad categories:

- Accuracy of the transactions tables, which refers to the exactness with which the I/O table represents the "true' table for economy.

This is the accounting interpretation of the I/O table, epitomized by those concerned with the preparation of the national tables, where the exercise is seen simply and appropriately as an extension of national accounts. This interpretation requires "cell-by-cell" accuracy in the statistical sense, on the assumption that if each cell of the table is an accurate record of the "true" transaction, the table as a whole will reflect the "true" table with a high degree of accuracy. This interpretation can be called partitive accuracy.

- Model accuracy, which refers to the exactness with which the I/O model reflects the realism of the operation of the regional economy.

This emphasizes the "snapshot" interpretation of the economy. This interpretation relies not on accuracy in each cell of the table, but on the accuracy with which the table represents the main features of the economy in a descriptive sense and preserves the importance of these features in an analytical sense. This interpretation of accuracy can be called holistic accuracy. While partitive accuracy represents the accounting accuracy of the table, holistic accuracy represents the operational accuracy of the table.

Modifications to the aggregation scheme

To overcome the aggregation problem, several alternative schemes were hypothesized and empirically tested. This problem arises due to the fact that there is usually no simple benchmark for comparison between differently derived tables for a given region. It was finally decided, in the interests of consistency and ease of manipulation, to continue the aggregation from the non-uniform tables to the uniform tables using employment weights. It was consider that the output-weights system is marginally superior, but there was a concern on the possibility that users of the tables could become disconcerted by the inevitable across-table-inconsistencies, despite the fact that across-table-comparisons require extreme caution.

The GRIT II system may still have some minor inconsistencies. Wholly-mechanically produced tables should not be inconsistent, but the GRIT system depends on operator manipulation at various stages of the procedure, with the insertion of superior data, etc. Very often, superior estimates are available for a particular industry at a regional level but not at the state level, or vice versa, or the two estimates are inconsistent but cannot be verified. It is virtually impossible to verify transactions across tables in any case, as each regional transaction between industries contains an element of imports and/or exports. It is maintained, however, that every effort is taken to ensure that obvious inconsistencies are minimized

The GRIT II Approach

West *et al.* (1980) extended the GRIT II methodology to the estimation of an interregional input-output table for regions of Queensland (GRIT III**).** The authors argued that the principles of GRIT could be applicable in an interregional context. However, their estimation approach was characterized by "intuitive reasoning" rather than empirical investigation, this being a deficiency of the GRIT III approach.

The GRIT III procedure involves the preparation of an interregional table from a number of single-region tables, i.e. the introduction of the spatial dimension into regional exports and imports by the disaggregation of regional trade vectors into interregional trade matrices, which are the main part of GRIT III. The trade matrices are initially estimated from the exports vectors of the single-region tables, and later balanced with the estimates of interregional imports. The GRIT III methodology is summarized in Table 2.

Phase I provides for the selection of regional tables, appropriate for inclusion in the interregional table, and for ensuring the accounting conformity of these tables. Step I involves the determination of the interregional table by the selection of appropriate regional tables. The economic interactions, which occur within the interregional table or interregional set, are endogenous to the model, with the "rest of the world" activities considered as exogenously determined. In principle, regional tables can be merged into interregional tables in any combination to study mutual economic interdependence between regions, or the behaviour of the economic system as a part or whole. Step 2 ensures conformity between the tables of the interregional set, as the tables at the time of merging need to conform to a uniform accounting format. Uniformity is necessary with respect to sector definition, methods of valuation of transactions, treatment of imports and of intrasectoral transactions, and preferably also, with respect to the time period to which each of the tables refers.

Phase II is concerned with the identification of the "significant" interregional trade flows. In keeping with the concept of holistic accuracy, special attention is paid to ensuring the accuracy of those cells of the table, which are expected to contribute significantly to the interregional multipliers. Where possible, superior data is provided for these cells. Step 3 provides for the identification of "significant" regional trade components, i.e. those components of exports shown to be significant by the single-region tables of the interregional set. Step 4 identifies the significant interregional trade flows and Step 5 provides for the insertion of the estimates of significant transactions to be locked in the relevant cells of the trade matrices.

Phase III provides for the estimation of those cells for which superior data are not available, and which are generally the less-significant cells of the table. Attention is given first, to those cells which are known or may be presumed to be zero and secondly, to the use of various allocation-methods for the distribution of the appropriate exports from each single-region table to the interregional set. Step 6 aims at the identification of zero cells, which arise in the obvious case where the single-region tables show that no trade occurs. Another source of zeros in the interregional table results from those flows that may be presumed to be exports to households (and not to sectors) in other regions of the interregional set. Also, source of zeros in the interregional trade matrices are exports, which by any standard, interregional or regional, are of no possible consequence in an analytical sense. Step 7 is concerned with the estimation of the remaining non-zero cells, by the allocation of regional trade estimates to interregional and intersectoral destinations. This is achieved through the use of various allocation methods to those regional trade flows not processed by methods already mentioned. Step 8 provides for the insertion of the estimates of trade flows from Step 6 and 7 into the table, and the preparation of the preliminary interregional table.

Table 2: The GRIT III methodological sequence

Phase I	**Selection and adjustment of regional tables**
1	Determination of the interregional set
2	Adjustments for accounting uniformity
Phase II	**Identification of significant trade flows**
3	Identification of significant regional trade components
4	Identification of significant interregional trade components
5	Insertion of superior data
Phase III	**Estimation of remaining trade flows**
6	Identification of zero cells
7	Allocation methods
8	Preparation of preliminary interregional trade
Phase IV	**Derivation of final tables and multipliers**
9	Ensuring the regional trade balance
10	Consistency checks
11	Analysis of sensitivity and coefficient significance
12	Derivation of inverses and multipliers for final transactions tables

Phase IV allows for the preparation of the final version of the interregional table. This involves ensuring that the regional trade-balance is observed, and that final tables are consistent. It also involves the observance of accuracy-optimizing principles, by identifying the "more critical coefficients" in multiplier formation and ensuring that the highest possible levels of accuracy have been observed in these coefficients. Finally, this phase provides for the calculation of the inverses and multipliers for the interregional tables. Step 9 provides a complete preliminary interregional table, the "best" table that can be produced by the combination of superior data and allocation methods, which although not fully mechanical in nature, do not rely heavily on the subjective judgment of the analyst. In Step 10, the professional judgment of the analyst is required in ensuring that the table is consistent in all respects and a fair representation of the interregional set within the context and meaning of holistic accuracy. Step 11 provides for the final testing of the interregional table by the use of sensitivity analysis developed by West (1981), and for the identification of the coefficients, which are more significant in the formulation of regional multipliers. The final step, Step 12, applies the usual procedure for the calculation of inverses with accompanying output, income and employment multipliers for the final transactions table.

Retaining the essential philosophy of the GRIT procedure, the GRIT III approach provides an interregional input-output table as an analytical and planning base. It allows economic analysis to be extended into a spatial dimension, and provide a deeper understanding of the economic interdependence among regions.

2.3 Environmental I/O Analysis: Ecological Commodities Model

Since the 1960s, several researchers extended the traditional Leontief I/O framework in order to account for environmental repercussions of interindustry activity. According to Miller and Blair (1985) three basic categories of environmental I/O models have been developed to account for pollution generation and abatement as well as for the production and consumption of ecological input and output commodities. These are:

- Generalized I/O Models / Ecological Commodities Model
- Economic-Ecologic Models
- Commodity-by-Industry Models

In all the above methods, the main problems have been i) the specification of the appropriate unit of measurement of environmental (or ecological) quantities), and ii) the availability of monetary or physical data on direct pollution generation and abatement and/or production and consumption of ecological commodities.

Taking into account the fact that one of the objectives of this work is to assess linkages between agriculture and the rest of the rural economy and water and land, as well as the fact that five of the selected test regions are facing problems of water or/and land stress (see Section 4 of this Report), this section presents a (rather) restricted version of the ecological commodities model, which will be utilized for this purpose. This version is restricted in the sense that it estimates ecological input coefficients as a function of total final demands.

The selection of this particular category of environmental I/O models is attributed to the objective of this study (i.e. to assess the link between sectoral economic activity and water/land consumption), as well as to the lack of regional data on ecological commodity outputs.

In more detail, the model could be utilized for the estimation aims of the direct and indirect impacts of inter-industry activity on factors such as energy consumption and thus, on natural resources such as land and water. The “full” version of the model views these factors as flows in and out of the ecosystem in which the inter-industry system exists, i.e. as ecological input and output commodities. As already mentioned, in this application, only ecological input component of this model will be utilized.

Hence, if a set of ecological commodity inputs is defined (e.g. water, land, air, etc.), their magnitudes are captured in a matrix M = $\lfloor m_{kj} \rfloor$, which reflects the amount of ecological input of type k used in the production of total output of economic sector j.

Subsequently, ecological commodity input coefficients are defined in the same way as Leontief technical coefficients. Thus, taking into account that A = $Z\left(\hat{X}\right)^{-1}$, ecological commodity input coefficients are defined as:

$$R = M\left(\hat{X}\right)^{-1} \quad (23)$$

where elements of R = $\lfloor r_{kj} \rfloor$ specify the amount of ecological commodity k required per euro’s worth of output of sector j.

Using R (equation 23) total impact coefficients (i.e. ecological commodity input coefficients as a function of final demand) can be computed as:

$$R^* = R\left(I - A\right)^{-1} \quad (24)$$

where elements in R* = $\left[r_{ij}^*\right]$ reflect the amount of ecological input i required directly and indirectly to deliver a Euro’s worth of industry j output to final demand.

In this work interdependence between sectoral economic activity and water and land consumption will be assessed through the estimation of sector-specific R*.

3 Assessing Inter-dependence in a Regional Economy through the Use of Regional I/O Models

3.1 Introduction

The objective of this section is to present the economic interdependence indicators which will be utilized in order to investigate synergy and interdependence between agriculture and the rest of the rural economy in 18 selected NUTS3 regions in the EU (Tasks 1.1 and 1.2 of the TWG2 work plan). More analytically, the analytical context proposed below draws from:

i) the specification of Step 1 of the working plan of TWG2, which aim at the investigation of links between agriculture and the rest of the rural economy in terms of use of farm output in the rest of the economy; provision of non-agricultural goods and services for the farm sector; supply and demand for production factors, and potential for diversification of farm activities.

ii) the utilization of certain criteria in order to select 18 NUTS3 test regions across the EU (see Section 4 below).

iii) the decision to carry out the investigation of linkages through the regional Input-Output (IO) analysis methodological framework.

iv) the decision to utilize IO-specific indicators of economic interdependence in order to identify factors which seem to be important in the determination of different patterns of interdependence.

v) work projected to be fulfilled under both Steps 1 and 2 of TWG2 work plan, aiming at utilizing interdependence analysis to construct a Typology of rural regions.

Within this context, several alternative (aggregate and detailed) measures of the nature and strength of inter-industry linkages were reviewed taking the above work objectives into account, and specific indicators are proposed here to be applied to the investigation of these objectives.

3.2 Conceptual Issues

The relationship of an economic sector with the rest of the economy through its direct and indirect purchases and sales is termed as “sectoral linkages”. Information on sectoral linkages is very important for the understanding of the structure of an economy and thus, for designing and implementing national and regional economic development policies.

The theoretical “background” of such an analysis draws from growth theory which has emphasized the role of a key sector being selected as a valuable tool to “induce” economic development through the strength of its sectoral linkages. Also, Marshallian agglomeration economies have focussed on local concentrations of interrelated economic activity and paid increased attention on the link between “regional success” examples based on the spatial concentration of interlinked sectoral activity.

In an IO model context, production by a sector has two types of economic effects on other economic sectors, known as backward (buyer) and forward (supplier) linkages. Despite the existence of wide controversy on their measurement, backward and forward linkages are widely-accepted concepts for measuring inter-sectoral relationships. The comparison of their strengths generates valuable comparisons between economies and also provides a means for identifying “key” or “leading” economic sectors (Miller and Blair, 1985), which can then be utilized by development policy efforts.

The importance of the strength of both backward and forward linkages to both national and regional development efforts has been well documented in the research literature (indicatively, see Chenery and Watanabe, 1958; Jones, 1976; Hewings, 1982; Miller and Blair, 1985; Porter, 1990; Sonis *et al.*, 1995; San Cristobal and Biezma, 2006). Comparatively tighter linkages may induce agglomeration externalities and improve competitiveness through (amongst others) productivity spillovers between sectors. Also, the scale of these linkages is an important factor determining local employment, income and output supported by the operation of an economic sector as well as (in a meta level) regional competitiveness. Along these lines, an indicator of industry interconnectedness could be a useful assessment tool.

Further, key sectors of an economy, displaying strong forward and/or backward linkages can be the focus of national or regional development efforts, though there should be attention on the relationship between high sectoral linkages and the ability of sectors to contribute to economic growth.

Indicatively, sectors with high economic linkages may well not be able to significantly contribute to local income, output, employment (Hewings, 1982), or export generation and import substitution (Diamond, 1976). In reply to such a case, methods such IO elasticities (Mattas and Shrestha, 1991) have been developed to take account both linkages and size of sectors when judging their potential to stimulate growth.

Also, in an IO context, an economic sector may be characterised by weak backward and forward linkages, but (on the other hand) by strong connections with the household sector. If a significant proportion of sectoral value added is “gained” by local households which in turn spend it on locally-produced products and services, then the capacity of this sector to generate economic growth can be far from negligible. Within this context, indicators which assess the effect of a change in final demand on demand for capital and labour can be estimated.

Further, the promotion of a sector based on the criterion of linkages can hit a rather important obstacle, which relates to the possible limited ability of linked sectors to expand their activity, due to (amongst others) labour supply constraints. Along these lines, an investigation of “supply-driven” multipliers which portray the economy-wide effects of a unitary increase in sectoral labour supply could be advised.

3.3 Proposed Inter-industry Linkages Indicators

Taking into account the investigation aims of Tasks 1.1 and 1.2 of TWG2 and the conceptual issues raised above, the following indicators are proposed to be estimated for the economies of the selected NUTS3 regions:

- backward and forward linkage indicators
- industry interconnectedness indicator
- IO elasticities
- value added index and multiplier
- cumulated primary input coefficient for compensation of employees
- Ghosh supply-driven multipliers

The detailed specification of the above indicators is presented below.

3.3.1 Forward and Backward Linkages

Forward and backward inter-industry linkages were introduced by Rasmussen (1956) and used for the identification of key sectors by Hirschman (1958) and Chenery and Watanabe (1958). This concept was further elaborated by several researchers (indicatively, Sonis and Hewings, 1999; Dietzenbacher, 1992) and widely applied to different economic sectors (Cella, 1984; Sonis et al., 1995; Aroca, 2001; Lenzen, 2003; etc.).

The backward linkage indicator captures the input demand (direct and indirect) effect. In other words, if sector j increases its output, this means increased demand from sector j on the sectors whose outputs are used as inputs to production of sector j (demand-driven model). Subsequently, the larger the value of a sector's backward linkage, the highest the sector's dependence on the rest of the economy, and thus, the highest the economy-wide effects of the expansion of sector j.

Taking into account the well-known Leontief equation,

$$X = Y[1-A]^{-1} \qquad (25)$$

where $[1-A]^{-1}$ is the Leontief inverse matrix (vertical column), of which elements b_{ij} account for the total direct and indirect outputs in sector i per unit of final demand in sector j, we can estimate backward linkage indicators for every sector (equivalent to output multipliers), as:

$$\mathrm{B}_{.j} = \sum_i b_{ij} / N \qquad (26)$$

To allow for inter-industry comparisons (as sectors in an economy are not identical in their size), estimates should be normalized through relating them to the global average:

$$\bar{b} = \sum_{ij} b_{ij} / N^2 \qquad (27)$$

Hence, the power of dispersion indicator can be estimated as:

$$U_{.j} = \frac{B_{.j}}{\bar{b}} \qquad (28)$$

In equation (28), the numerator measures the average stimulus to other sectors, according to the share of each sector in total final demand, resulting from a unitary increase in final demand for the output of sector j. In turn, the denominator measures the average stimulus to the whole economy resulting from a unitary increase in the final demand for the output of all sectors.

In turn, the forward linkage indicator represents the demand by each sector for the output of sector j. Increased output of sector j means additional amount of sector j products that are available to be used as inputs to the production of the other sectors in the economy. In other words, "forward linkage" indicates the direct and indirect interconnections between a sector and the sectors to which it sells their output (Miller and Blair, 1985). The larger the forward linkage, the higher the economy-wide stimulus originating from this sector.

In order to derive the forward linkage indicator, the Leontief inverse matrix is rotated from a vertical column view, to a horizontal one, through dividing each row of z (z_{ij} are the sales from sector i to sector j) by the gross output of the sector associated with that row:

$$\vec{a}_{ij} = \frac{z_{ij}}{X_i} \qquad (29)$$

Using $\vec{A}$ to denote the direct output coefficients matrix, we specify the supply-driven model as:

$$X' = V\left[1 - \vec{A}\right]^{-1} \qquad (30)$$

where V is the vector of value-added items and $\left[1 - \vec{A}\right]^{-1}$ the row view Leontief inverse, whose elements $(\vec{b}_{ij})$ represent direct and indirect requirements in sector j per unit of value added in sector i.

Hence, the elements of the forward linkages are derived as:

$$B_{i.} = \sum_j \vec{b}_{ij} / N \qquad (31)$$

To allow for inter-industry comparisons, linkages are also normalized (as in equation 27) and the sensitivity of dispersion indicator is produced as:

$$U_{i.} = \frac{B_{i.}}{\bar{b}} \qquad (32)$$

Taking the above specifications into account, a sector is characterized as "key sector" if both the power of dispersion and sensitivity of dispersion indicators have a value over one, i.e. above-average dependence and influence on other sectors. However, as high linkages can occur due to many high b_{ij} or to few very high b_{ij}, the estimation of column and row coefficients of variation is advocated (Lenzen, 2003); these coefficients should be low for key sectors.

3.3.2 Industry Interconnectedness Indicator

An index of industry interconnectedness deals with the number of direct and indirect transactions between industries and thus, provides information on the degree of outsourcing and diversification in an economy. A higher number of purchases indicate outsourcing, while a high number of sales to other sectors indicate an increase in diversification.

Following Soofi (1992), a measure of concentration is calculated in the form of two indicators. The backward concentration index is specified as:

$$G_{.j}(b_{ij}) = \left[N\left(1 - \sum_{i=1}^{N}(c_{.j,ij})^2\right)\right]^{1/2} \qquad (33)$$

and the forward index as:

$$G_{i.}(b_{ij}) = \left[N\left(1 - \sum_{j=1}^{N} (c_{i.,ij})^2\right)\right]^{1/2} \quad (34)$$

where $c_{.j,ij} = \frac{b_{ij}}{\sum_{i=1}^{N} b_{ij}}$ and $c_{i.,ij} = \frac{b_{ij}}{\sum_{j=1}^{N} b_{ij}}$ (35 and 36)

If concentration is measured to be high, then outsourcing (backward index) and diversification (forward index) are also high and vice-versa.

3.3.3 Input-Output Elasticities

IO elasticity coefficients were developed by Mattas and Shrestha (1991) in an effort to take economic size into account in the calculation of interindustry linkages indicators.

In more detail the authors argue that despite the fact that the domestic inverse is an appropriate measure of identifying important sectors in an economy, the calculation of backward linkage indicators can mislead policy-makers on the importance of this sector, because they do not take into account the relative size of this sector. In other words in the case of a sector characterised by its small relative size, even a significant increase of its final demand will add little to the economy's output, income and employment.

In turn, elasticities take the relative size of sectors into account and thus, provide a more reliable way of identifying key sectors in an economy.

In an IO framework, output elasticity is defined as:

$$OE_{xyj} = \sum_{i} b_{ij}(y_j / x) \quad (37)$$

where OE_{xyj} is the percentage change in total output induced by a percentage change in final demand for sector j, $x = \sum x_i$, b_{ij} is drawn from the Leontief matrix and y_j from the final demand vector.

In relevance to the direct effect estimated for the calculation of multipliers, a direct output elasticity can be estimated, representing the percentage change in the output of sector j due to a percentage change in final demand for this sector:

$$DOE_{xjyj} = b_{jj}(y_j / x_j) \quad (38)$$

The difference between OE and DOE is the indirect output elasticity and represents change in economy-wide output arising from changes in other sectors induced by a percentage change in the final demand for sector j.

In a similar manner, employment elasticities (EE) and income elasticities (IE) can be estimated as:

$$\mathrm{EE}_{xyj} = \left[\sum_{i} (l_i / x_j) b_{ij} / (l_j / x_j)\right] (y_j / x) \quad (39)$$

and

$$IE_{xyj} = \left[\sum_i (h_i / x_j) b_{ij} / (h_j / x_j) \right] (y_j / x) \tag{40}$$

where l_i is employment, h_i is wages and salaries, and the ratios l_i/x_j and h_i/x_j are the employment and income coefficients.

In general, IO elasticities are considered as a more appropriate measure if the identification of key sectors aim at an expansion of their final demand, while conventional backward linkage indicators are more suitable if the aim is to assess the potential of a sector to generate economy-wide effects.

3.3.4 Value Added Index and Multiplier

To investigate the effect of a change in final demand on value added, a value added index can be estimated (Claus and Li, 2003). Such an index can provide information on the links between sectoral economic activity and capital as it is an estimate of the increase in value added resulting from higher final demand for the output of sector j. Such an index can be derived as:

$$BV.j = \frac{b^v_{.j}}{(1/N)\sum_{j=1}^{N} b^v_{.j}} \tag{41}$$

where $b^v_{.j} = \sum_{i=1}^{N} b_{ij} \frac{v_i}{x_i}$ is the input requirement for a unitary increase in final demand for the output of sector j, weighted by each sector's ratio of value added v_i to gross output x_i.

Alternatively, a value added production multiplier can be used in order to indicate the direct and indirect contribution of a unitary increase in final demand to value added in sector j. This can be derived as:

$$D_{.j} = v_j b^w_{.j} \tag{42}$$

where $b^w_{.j}$ is the input requirement for a unitary increase in the final demand for sector j output, weighted by each sector's share in total final demand.

- *(e) Cumulated Primary Input Coefficient for Compensation of Employees*

In order to investigate the importance of each sector in terms of its contribution to employment in an economy, a cumulated primary input coefficient for compensation of employees can be estimated (Statistics New Zealand, 1989). This coefficient measures the direct and indirect impacts on wages and salaries, induced by a unitary increase in the output of sector j. This coefficient is calculated as:

$$E_{lj} = \frac{m_{lj} x_j}{\sum_{j=1}^{N} p_{lj} + \sum_{k=1}^{K} p_{lk}} \tag{43}$$

where p_{lj} is the primary input l used by sector j, p_{lk} is the primary input l absorbed by final demand category k, K is the number of final demand categories, and $M = \lfloor m_{lj} \rfloor$ with M = P^wB, where $P^w = \left[p_{lj}^w\right]$ is the matrix of sectors' primary inputs weighted by their total gross output, i.e. $p_{lj}^w = \frac{p_{lj}}{x_j}$

3.3.5 Ghosh Supply-Driven Multipliers

The estimation of interindustry linkages through the use of supply-driven multipliers can help overcome the (rather crucial at the regional level) IO assumption on the ability of supply to fully satisfy changes of final demand. This is due to the fact that (in contrast to conventional demand-driven analysis) supply models assume exogenous shocks on outputs rather than on final demand (or primary inputs).

Supply-driven multipliers utilized here draw from research efforts by Miller and Blair (1985) and Cai and Leung (2004) and have been used by several researchers including Papadas and Dahl (1999) and Leung and Pooley (2002).

Technically, in a forward linkage context, a modified Ghosh inverse $\left(I - \mathrm{B}^*\right)^{-1}$ is derived from dividing each element (β_{ij}) of $\left(I - \mathrm{B}\right)^{-1}$ by the diagonal element in its row (β_{ii}). Then, $GSD_i = \beta_{i.}^*$, where $\beta_{i.}^*$ is the ith row sum of $\left(I - \mathrm{B}^*\right)^{-1}$.

This particular type of multiplier can portray the economy-wide effects which correspond to a unitary increase of sectoral labour supply.

4 Application

4.1 Study Area Selection

As noted in the technical specifications of the TWG2 Tasks, the investigation of synergy and interdependence between agriculture and the rest of the rural economy has to be carried out in representative EU regions classified according to several criteria including (as a major criterion) the relative importance of agriculture.

To this end, the research team utilized the modified OECD typology in order to select the TWG2 test regions. Then a cluster analysis based on several criteria was used in order to classify NUTS 3 regions into three types and subsequently to select 18 test regions for further analysis.

4.1.1 Data Availability and Analysis

Regional Typologies

It was decided that the selection of test regions and the development of the TWG2 regional typologies will be based on the OECD refined typology which classifies region at the NUTS 3 level to six types as:

- Rural Peripheral Areas (RPR)
- Rural Accessible Areas (RAR)
- Intermediate Open Space (IOR)
- Intermediate Closed Space
- Urban Open Space
- Urban Closed Space

The 1303 NUTS3 areas for the 27 member states are classified in the aforementioned 6 categories as it is shown in the Table 3.

Table 3: Refined OECD Typology of NUTS 3 Regions

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Rural Peripheral	137	10.5	10.9	10.9
	Rural Accessible	254	19.5	20.1	31.0
	Intermediate Open Space	192	14.7	15.2	46.2
	Intermediate Closed Space	261	20.0	20.7	66.9
	Urban Open Space	124	9.5	9.8	76.8
	Urban Closed Space	293	22.5	23.2	100.0
	Total	1261	96.8	100.0	
Missing	-9999.0	42	3.2		
Total		1303	100.0		

Source: Authors' calculations.

The 42 missing cases refer to all 28 NUTS3 areas in Bulgaria, 8 areas in Spain (Melilla and the seven Canary Islands regions), the 4 overseas departments of France and 2 Portuguese regions (Acores and Madeira).

According to the decision taken at a Brussels meeting in April 2009, this study focuses on three types of regions, namely RPR, RAR and IOR. These types of areas make up 44.7% of all NUTS 3 regions and 46.2% of the total valid cases. When the Intermediate Open Space and the two types of urban areas are excluded, the sample contains 583 observations, whose frequencies are described in the following table.

Table 4: Rural and Intermediate Open Space Areas - Frequencies

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Rural Peripheral	137	23.5	23.5	23.5
	Rural Accessible	254	43.6	43.6	67.1
	Intermediate Open Space	192	32.9	32.9	100.0
	Total	583	100.0	100.0	

Source: Authors' calculations.

Criteria for the Classification of Regions

It was decided that the following 6 criteria will guide the test regions selection process:

1 Degree of Importance of Agriculture

2 Importance of the Food Industry

3 Importance of Tourism (in terms of availability of natural resources and accommodation facilities)

4 Demographic Evolution

5 Competition for water resources from agriculture

6 Competition for land resources from agriculture

Further, most data on the above criteria will be collected and analyzed for years as close as possible to 2005, a year with relatively good data availability and without having being affected by the NUTS 3 changes of the recent 2007-08 years that are not included in the refined OECD typology.

The degree of agriculture's importance was assessed by agriculture's contribution to the region's GDP. Due to the fact that regional NUTS 3 data are not available for either GDP or agriculture, it was decided to calculate this index by estimating the proportion of the primary's sector GVA to total GVA from Eurostat data and for 2005. Three observations are missing and thus the sample's effective size reduces to 580 NUTS 3 regions. Tables 5 and 6 present the indicator's descriptive statics in total and for each category of the typology.

Table 5: Descriptive Statistics for the Primary Sector Contribution to Gross Value Added (%)

	N	Minimum	Maximum	Mean	Std. Deviation
%GVA Primary	580	.483	26.871	5.57879	4.762368
Valid N (listwise)	580				

Source: Authors' calculations.

Table 6: The Primary Sector Contribution to Regional GVA for the Three Types of Areas

Refined OECD Classes	Mean	N	Std. Deviation
Rural Peripheral	7.92118	136	5.125863
Rural Accessible	6.25861	252	4.997977
Intermediate Open Space	3.02734	192	2.508889
Total	5.57879	580	4.762368

Source: Authors' calculations.

The average contribution of the primary's sector to regional GVA is 5.6%, which, as expected is very high, 7.92% and 6.25% for RPR and RAR correspondingly and only 3.02% for IOR.

The importance of the Food Industry in the regional economy was assessed through the industry's share out of the total manufacturing employment. Unfortunately, no data are available to the NUTS 3 level and thus we had to assume that the average NUTS 2 values hold for the NUTS 3 areas as well. Twenty nine (29) observations are missing, 12 from the German NUTS 2 region (DE8), 12 from the whole of Slovenia and 5 from the UK NUTS 2 region (UKM). Thus the sample's effective size reduces to 551 NUTS 3 regions. Tables 7 and 8 present the indicator's descriptive statics in total and for each category of the typology.

Table 7: Descriptive Statistics of Food Industry's Contribution to Total Manufacturing Employment (%)

	N	Minimum	Maximum	Mean	Std. Deviation
Employment	551	4.400	49.600	15.77405	8.239799
Valid N (listwise)	551				

Source: Authors' calculations.

Table 8: The Food Industry's Contribution to Regional Employment in the Manufacturing Sector for the Three Types of Areas

Refined OECD Classes	Mean	N	Std. Deviation
Rural Peripheral	19.60078	129	9.893270
Rural Accessible	15.64085	235	6.714128
Intermediate Open Space	13.30160	187	7.769761
Total	15.77405	551	8.239799

Source: Authors' calculations.

The average contribution of the Food Industry's to total manufacturing employment is 15.77% which, as expected is very high, 19.6% and 15.64% for RPR and RAR correspondingly and only 13.30% for IOR.

The Importance of Tourism (in terms of availability of natural resources and accommodation facilities) was assessed through an indicator constructed by DG REGIO for the "Green Paper on Territorial Cohesion" (Annex to the Green Paper -- Map 6), which calculates the average of the three proximity indicators, namely the areas with natural vegetation and forests, the areas with water bodies and the areas with Natura 2000 all population-weighted. Thus the indicator focuses on availability and proximity of nature resources to population. Tables 9 and 10 present the indicator's descriptive statics in total and for each category of the typology.

Table 9: Descriptive Statistics of the Indicator for Availability of Natural Resources for Tourism

	N	Minimum	Maximum	Mean	Std. Deviation
Availability	583	15.758	348.198	134.27489	61.336823
Valid N (listwise)	583				

Source: Authors' calculations.

Table 10: The Availability of Natural Resources for Tourism for the Three Types of Areas

Refined OECD Classes	Mean	N	Std. Deviation
Rural Peripheral	172.16274	137	65.844377
Rural Accessible	126.32722	254	55.274967
Intermediate Open Space	117.75445	192	54.237897
Total	134.27489	583	61.336823

Source: Authors' calculations.

The average indicator is 134.2 which, as expected, is very high, 172.16 for RPR and lower, 126.33 and 117.75 correspondingly for RAR and for IOR.

Alternatively, an indicator of availability of beds per thousand of population in 2005, known as the tourism service indicator was calculated. Tables 11 and 12 present the indicator's descriptive statics in total and for each category of the typology.

Table 11: Descriptive Statistics of the Service Indicator (Beds per '000 of population in 2005)

	N	Minimum	Maximum	Mean	Std. Deviation
Beds per '000 of Inhabitants	579	.00	84.21	1.0790	4.04702
Valid N (listwise)	579				

Source: Authors' calculations.

Table 12: The Tourism Service Indicator for the Three Types of Areas

Refined OECD Classes	Mean	N	Std. Deviation
Rural Peripheral	2.2426	133	7.54018
Rural Accessible	.8142	254	2.07859
Intermediate Open Space	.6233	192	1.81767
Total	1.0790	579	4.04702

Source: Authors' calculations.

The average indicator is 1.08 beds per thousand inhabitants which, is almost double (2.24) for RPR and lower than the average, 0.81 and 0.62 correspondingly for RAR and for IOR. The two indicators i.e., availability of natural resources for tourism and beds per thousand inhabitants are highly correlated and can be used interchangeably.

Demographic evolution was assessed through regional population change between 1995 and 2005. Data are available at NUTS 3 level. Five (5) observations are missing from Denmark (DK022, DK041, DK042, DK050, DK032). Thus the sample's effective size reduces to 575 NUTS 3 regions. Alternative indicators include the population's natural movement during the same period and net migration. Both these indicators, however, suffered from many missing observations and thus it was decided to use only the indicator of population change. Tables 13 and 14 present the indicator's descriptive statics in total and for each category of the typology.

Table 13: Descriptive Statistics of Population Change 1995-2005 (%)

	N	Minimum	Maximum	Mean	Std. Deviation
Population Change	575	-28.630	32.723	1.37340	6.480445
Valid N (listwise)	575				

Source: Authors' calculations.

Table 14: Population Change 1995-2005 (%) for the Three Types of Areas

Refined OECD Classes	Mean	N	Std. Deviation
Rural Peripheral	-.28777	134	6.400464
Rural Accessible	1.07944	250	6.347618
Intermediate Open Space	2.92359	191	6.396624
Total	1.37340	575	6.480445

Source: Authors' calculations.

Average population change in 1995-2005 is 1.37% which, as expected is negative for RPR (-0.28%), around one for RAR (1.08%) and 2.92% for IOR.

The construction of an indicator for competition for water resources was a rather complicated issue. An indicator for water abstraction according to different water uses (agriculture, manufacturing industry and municipal use) is available at national level either from AQUASTAT the FAO's database for water abstraction or the European Environment Agency (EEA). Unfortunately, no information at regional level is available. Furthermore there are not actual regional water supply levels that could be used in the estimation of a regional water stress indicator. The only stress indicators for Europe are those produced by hydrological and environmental models and are not publicly available. Thus, we decided that one objective measure that could be used to distribute the national abstraction levels to the regional level is the regional amount of irrigable land. At NUTS 3 level this is recorded by the 2003 Farm Structure Survey. From this survey however, whole countries such as Germany, Finland and Austria record missing values. On the other hand, all Mediterranean countries suspect to suffer from water shortages and probably with major conflicts over water use are all present with full data at the NUTS 3 level. In order to de-scale the effect of the irrigable land (large areas having more irrigable areas) we estimated a location quotient of irrigable lands as:

$$LQ = \frac{I_r / AA_r}{I_n / AA_n}$$

where I_r is the irrigable area of the region r, AA_r is the agricultural area of the region r and I_n and AA_n are the irrigable and agricultural area of the whole country correspondingly. Thus, irrespective of the size of the region, we estimate how much more irrigated are the agricultural areas of the region with respect to the nation's average. Table 15 summarizes for each one of the Mediterranean countries the ten regions with the highest irrigable land location quotients in ascending order.

Table 15: The ten regions with the highest location of irrigable land for each of Mediterranean country

Greece		Spain		Italy		Portugal		France	
NUTS	Name	NUTS	Name	NUTS	Name	NUTS	Name	NUTS	Name
GR113	Rodopi	ES211	Álava	ITF52	Matera	PT165	Dão-Lafões	FR106	Seine-Saint-Denis
GR244	Fthiotida	ES514	Tarragona	ITD51	Piacenza	PT167	Serra da Estrela	FR628	Tarn-et-Garonne
GR114	Drama	ES522	Castellón de la Plana	ITC16	Cuneo	PT116	Entre Douro e Vouga	FR422	Haut-Rhin
GR112	Xanthi	ES230	La Rioja	ITD37	Rovigo	PT111	Minho-Lima	FR614	Lot-et-Garonne
GR125	Pieria	ES413	León	ITC15	Novara	PT16A	Cova da Beira	FR832	Haute-Corse
GR144	Trikala	ES513	Lérida	ITC48	Pavia	PT185	Lezíria do Tejo	FR242	Eure-et-Loir
GR115	Kavala	ES521	Alicante	ITD56	Ferrara	PT115	Tâmega	FR246	Loiret
GR124	Pella	ES241	Huesca	ITC47	Brescia	PT114	Grande Porto	FR613	Landes
GR141	Karditsa	ES613	Huelva	ITC49	Lodi	PT113	Ave	FR824	Bouches-du-Rhône
GR121	Imathia	ES523	Valencia	ITC12	Vercelli	PT112	Cávado	FR105	Hauts-de-Seine

Source: Authors' calculations.

Competition for agricultural land resources was primarily thought of as the pressure applied from other uses on agricultural land. The major land use changes threatening agricultural land are the spread of residential areas and the spread of urban land for infrastructure and the establishment of economic sites. The CORINE database provides estimates of land use for 1990 and 2000 and also estimates of land use change among the different uses. The data are publicly available from the European Environment Agency's website. The problem is that from this publicly available database whole countries such as Finland and Sweden are missing while others such as Hungary and Poland suffer from extreme proportions of missing values. We decided to calculate an indicator of the land used for urban and residential sprawl plus sprawl of economic sites and infrastructure between 1990 and 2000 from the land flows database as a percentage of agricultural land in 1990 from the land use database. Thus, the calculated indicator is:

Competition for land resources=Urban residential sprawl (1990-2000 LCF2 CORINE Indicator, NUTS3) + Sprawl of economic sites and infrastructure (1990-2000 LCF3 CORINE Indicator, 1990-2000, NUTS3)/Total Agricultural Area (CLCO2 CORINE, 1990). Tables 16 and 17 present the indicator's descriptive statics in total and for each category of the typology.

Table 16: Descriptive Statistics of Residential Land Use Change as a Percentage of Agricultural Area

	N	Minimum	Maximum	Mean	Std. Deviation
Change	436	.00	3.91	.4724	.47832
Valid N (listwise)	436				

Source: Authors' calculations.

Table 17: Land Use Change 1990-2000 as a Percentage of Agricultural Area for the Three Types of Areas

Refined OECD Classes	Mean	N	Std. Deviation
Rural Peripheral	.3355	79	.42970
Rural Accessible	.3658	193	.35563
Intermediate Open Space	.6638	164	.56021
Total	.4724	436	.47832

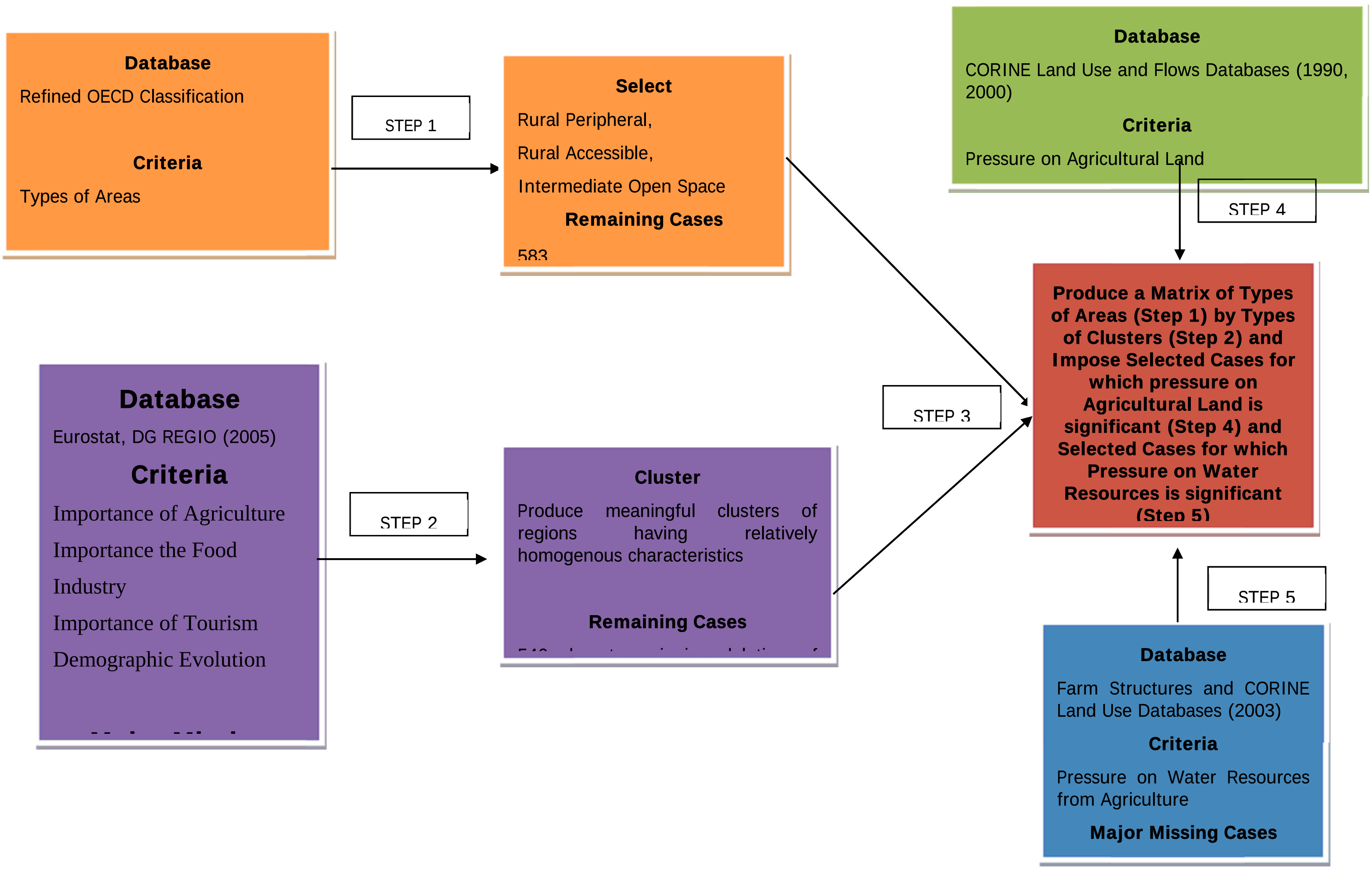
Source: Authors' calculations.

The effective sample size drops from 583 to 436 i.e., over 25% due to extensive missing values. As expected, the rural peripheral and rural accessible areas experience the lowest percentages (0.34%) while intermediate open space areas are up to 0.66%.

4.1.2 Test-Region Selection Process

In proceeding with area selection we have two options: First, to merge all databases and try and apply a cluster analysis that will classify regions into meaningful and relatively homogenous groups of regions, risking of course to drop out of the analysis a significant amount of regions (even whole countries). Second, to proceed with a cluster analysis using only the first four indicators for which missing values are relatively restricted and then superimpose the data for water resources and stress on land resources.

The graph below shows the processes followed in order to select the test regions. At the first step we isolated from the refined OECD classification the three types of regions that are of the highest interest to the present work. The remaining 583 cases are all classified according to these types of regions. At the second step we constructed a database of all available proxies for the criteria we set for selecting the regions. Then we performed a cluster analysis which produced three relatively homogenous groups of regions. The details of the cluster analysis are presented in the next section of this report. As it is shown in the figure below, indicators related to either land or water pressure were not included in this stage of the analysis because the effective size of the sample of regions would be reduced significantly due to the many missing cases in the water and land related databases. At the third step we produced a 3x3 matrix of types of areas by types of clusters which form 9 cells each one including a number of regions. At the fourth and fifth steps, from the regions already allocated to the 9 cells, we selected regions that present either a high relative demand for irrigation water or a demand for land by non-agricultural uses. Finally, it was assured (in an ex-post manner) that two of the selected regions were mountainous ones.



Database
Refined OECD Classification
Criteria
Types of Areas
STEP 1
Select
Rural Peripheral,
Rural Accessible,
Intermediate Open Space
Remaining Cases
583
Database
CORINE Land Use and Flows Databases (1990, 2000)
Criteria
Pressure on Agricultural Land
STEP 4
Produce a Matrix of Types of Areas (Step 1) by Types of Clusters (Step 2) and Impose Selected Cases for which pressure on Agricultural Land is significant (Step 4) and Selected Cases for which Pressure on Water Resources is significant (Step 5)
STEP 3
Database
Eurostat, DG REGIO (2005)
Criteria
Importance of Agriculture
Importance the Food Industry
Importance of Tourism
Demographic Evolution
STEP 2
Cluster
Produce meaningful clusters of regions having relatively homogenous characteristics
Remaining Cases
STEP 5
Database
Farm Structures and CORINE Land Use Databases (2003)
Criteria
Pressure on Water Resources from Agriculture
Major Missing Cases

4.1.3 The Cluster Analysis

A hierarchical cluster analysis minimizing Euclidian distances was employed. Several of the indicators entered the analysis and several attempts were made using SPSS V.15 until the cluster analysis with the best statistical properties was derived. The initial and final cluster centres as well as the iteration history of the best model are presented below.

Initial Cluster Centers

	Cluster		
	1	2	3
%GVAAgri	1.184	4.487	.823
Employ	12.100	16.500	8.800
Availability	169.051	15.758	319.626
PopChan	-28.630	.000	1.869

Iteration History[a]

	Change in Cluster Centers		
Iteration	1	2	3
1	33.327	49.587	60.095
2	2.448	8.865	24.793
3	2.200	1.608	6.667
4	1.758	.000	3.337
5	1.599	.645	1.813
6	1.079	.322	1.386
7	.694	.323	.702
8	.514	.322	.352
9	.000	.000	.000

a. Convergence achieved due to no or small change in cluster centers. The maximum absolute coordinate change for any center is .000. The current iteration is 9. The minimum distance between initial centers is 153.669.

Final Cluster Centers

	Cluster		
	1	2	3
%GVAAgri	4.899	6.524	5.130
Employ	14.769	15.524	17.833
Availability	144.474	74.042	221.699
PopChan	.630	2.506	1.331

Table 18 shows the average of each of the used criteria for each one of the clusters. The first cluster (cluster 1) is characterized by low to average importance of agriculture, low contribution of the food industry, medium availability/proximity of resources for tourism development and stagnant population. We call this cluster Non-Dynamic Areas. The second cluster (cluster 2) is characterized by areas with important agriculture in terms of its contribution to total regional GVA, medium importance of the food sector and availability and proximity of resources but high population change. We call this cluster Agriculturally-Dependent Dynamic areas with Low Internal Llinks. The third cluster (cluster 3) is characterized by medium importance of agriculture, very high importance of the food industry, high importance of tourism, and medium to high population growth. We call this cluster Diversified Dynamic Areas with High Links.

Table 18: Cluster Report

		Importance of Agriculture	Employment in the Food Sector	Availability of Natural Resources for Tourism	Population Change
Cluster 1	Mean	4.89041	14.75592	144.02676	.56383
	N	211	211	211	211
Cluster 2	Mean	6.52402	15.52422	74.04244	2.50615
	N	223	223	223	223
Cluster 3	Mean	5.35464	18.09018	220.83888	1.43010
	N	112	112	112	112
Total	Mean	5.65285	15.75366	131.19975	1.53482
	N	546	546	546	546

Source: Authors' calculations.

Table no 19 shows the allocation of the NUTS 3 areas to the three clusters.

Table 19: Cluster Number of Case

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Non-Dynamic Areas	211	36.2	38.6	38.6
Agriculturally-Dependent Dynamic Areas/Low Links	223	38.3	40.8	79.5
Diversified Dynamic Areas High Links	112	19.2	20.5	100.0
Total	546	93.7	100.0	
Missing	37	6.3		
Total	583	100.0		

Source: Authors' calculations.

Table 20 shows how the regions under of the three types of the refined OECD typology fit in the clusters creating the 3x3 matrix of step 3 in the aforementioned process. Below we also provide a detailed account of cluster membership, i.e the NUTS 3 areas belonging to each cluster.

Table 20: Refined OECD Typology Categories by Cluster Categories

Clusters			Categories of the Refined OECD Typology: Rural Peripheral	Rural Accessible	Intermediate Open Space	Total
Non-Dynamic Areas	1	Count	38	96	77	211
		% within Cluster Number of Case	18.0%	45.5%	36.5%	100.0%
		% within TYPESII	29.9%	41.2%	41.4%	38.6%
		% of Total	7.0%	17.6%	14.1%	38.6%
Agriculturally-Dependent Dynamic Areas/Low Links	2	Count	28	104	91	223
		% within Cluster Number of Case	12.6%	46.6%	40.8%	100.0%
		% within TYPESII	22.0%	44.6%	48.9%	40.8%
		% of Total	5.1%	19.0%	16.7%	40.8%
Diversified Dynamic Areas High Links	3	*Count*	*61*	*33*	*18*	*112*
		% within Cluster Number of Case	*54.5%*	*29.5%*	*16.1%*	*100.0%*
		% within TYPESII	*48.0%*	*14.2%*	*9.7%*	*20.5%*
		% of Total	11.2%	6.0%	3.3%	20.5%
Total		Count	127	233	186	546
		% within Cluster Number of Case	23.3%	42.7%	34.1%	100.0%
		% within TYPESII	100.0%	100.0%	100.0%	100.0%
		% of Total	23.3%	42.7%	34.1%	100.0%

Source: Authors' calculations.

Finally, membership in each of the three clusters is presented below.

Membership in Cluster 1 – Non Dynamic Areas:

- Austria: AT111, AT112, AT113, AT121, AT124, AT126, AT213, AT224, AT225, AT226, AT313, AT315
- Belgium: BE336, BE341, BE342, BE351, BE353
- Czech Republic: CZ072
- Germany: DE11C, DE11D, DE127, DE12A, DE12C, DE132, DE133, DE134, DE135, DE136, DE137, DE13A, DE143, DE149, DE218, DE219, DE21K, DE21M, DE21N, DE225, DE226, DE234, DE235, DE236, DE237, DE239, DE23A, DE245, DE246, DE248, DE24A, DE24C, DE24D, DE25B, DE265, DE266, DE267, DE269, DE26A, DE26C, DE27E, DE416, DE417, DE424, DE425, DE724, DE732, DE733, DE734, DE735, DE926, DE931, DE932, DE934, DE938,

DEA44, DEA5B, DEB13, DEB1B, DEB22, DEB23, DEB24, DEB25, DEB3D, DEB3F, DEB3H, DED17, DED18, DED1B, DED26, DEE09, DEE0E, DEF07, DEG0A, DEG0E, DEG0F, DEG0H, DEG0I, DEG0K, DEG0P

- Denmark: DK014
- Estonia: EE006
- Spain: ES112, ES113, ES120, ES241, ES242, ES417, ES419, ES423, ES431, ES521, ES522, ES620
- Finland: FI184, FI185, FI194, FI196
- France: FR214, FR245, FR262, FR412, FR414, FR432, FR433, FR611, FR613, FR621, FR625, FR712, FR722, FR723
- Greece: GR111, GR112, GR126, GR131, GR132, GR134, GR144, GR211, GR222, GR232, GR241, GR242, GR251, GR253, GR255
- Hungary: HU213, HU223, HU231, HU232, HU311, HU312, HU313
- The Republic of Ireland: IE013
- Italy: ITE18, ITE19, ITE1A, ITE22, ITE31, ITE42, ITE44, ITE45, ITF51, ITF61, ITF63, ITF64, ITF65, ITG11, ITG16, ITG19, ITG25, ITG28
- Latvia: LT001, LT007, LT009
- Lithuania: LV009
- Poland: PL122, PL215, PL225, PL312, PL345, PL411, PL422, PL423, PL431, PL432, PL622, PL623, PL631, PL634
- Portugal: PT115, PT117, PT118, PT163, PT169, PT16C, PT183, PT184
- Romania: RO112, RO412, RO413, RO415, RO423
- Sweden: SE121, SE122, SE123, SE124, SE125, SE214
- Slovenia: SK022, SK032
- United Kingdom: UKL11

Membership in Cluster 2 – Agriculturally-dependent Dynamic areas with Low Links:

- Austria: AT123, AT125, AT311, AT314
- Belgium: BE252, BE253, BE321
- Czech Republic: CZ063
- Germany: DE119, DE11A, DE11B, DE145, DE146, DE148, DE214, DE21A, DE21B, DE21E, DE21I, DE21J, DE224, DE227, DE228, DE22A, DE22B, DE22C, DE238, DE249, DE24B, DE256, DE25A, DE25C, DE268, DE26B, DE275, DE277, DE278, DE27B, DE27C, DE27D, DE914, DE918, DE91A, DE91B, DE922, DE923, DE927, DE933, DE936, DE937, DE93A, DE93B, DE946, DE947, DE948, DE949, DE94A, DE94B, DE94C, DE94D, DE94E, DE94F, DE94G, DE94H, DEA28, DEA35, DEA38, DEA47, DEB3B, DEB3G, DEC06, DED19, DED24, DED32, DED33, DED36, DEE04, DEE07, DEE0D, DEF0C, DEG06, DEG07, DEG09, DEG0D, DEG0G
- Spain: ES211, ES230, ES414, ES418, ES421, ES422, ES425, ES513, ES614, ES616
- France: FR241, FR243, FR252, FR253, FR264, FR513, FR515, FR521, FR531, FR533, FR614, FR622, FR624, FR628, FR632, FR826

- Greece: GR113, GR114, GR121, GR123, GR124, GR125, GR133, GR141, GR142, GR233
- Hungary: HU211, HU233, HU322, HU323, HU331, HU332, HU333
- The Republic of Ireland: IE011, IE012, IE022, IE023, IE024, IE025
- Italy: ITC12, ITC16, ITC17, ITC18, ITC48, ITC49, ITC4A, ITD37, ITD41, ITD51, ITD52, ITD56, ITD58, ITE17, ITE21, ITE32, ITE33, ITE34, ITE41, ITF12, ITF14, ITF22, ITF32, ITF41, ITF52, ITG14, ITG15, ITG2B
- Lithuania: LT004
- The Netherlands: NL111, NL112, NL122, NL123, NL132, NL133, NL225, NL341
- Poland: PL115, PL116, PL117, PL121, PL214, PL216, PL311, PL315, PL324, PL325, PL332, PL344, PL414, PL416, PL417, PL418, PL518, PL614, PL615, PL621, PL635
- Portugal: PT185
- Romania: RO113, RO115, RO116, RO121, RO122, RO123, RO124, RO125, RO126, RO211, RO212, RO214, RO215, RO216, RO222, RO224, RO226, RO312, RO313, RO314, RO315, RO317, RO322, RO414, RO421
- Slovakia: SK023
- United Kingdom: UKL24, UKM24, UKM32, UKN05

Membership in Cluster 3 – Diversified, Dynamic Areas with High Links:

- Austria: AT212, AT222, AT321, AT322, AT331, AT332, AT333, AT334, AT335, AT341
- Belgium: BE343, BE344, BE345
- Germany: DE215, DE21D, DE21F, DE229, DE259, DE418, DE725, DE736, DE737, DEA57, DEB12, DEB15, DEB16, DEB1A, DEB3E, DEB3K
- Spain: ES411, ES416, ES432, ES531, ES533, ES611
- Finland: FI131, FI132, FI133, FI134, FI182, FI187, FI193, FI195, FI197, FI1A1, FI1A2, FI1A3, FI200
- France: FR814, FR821, FR822, FR831, FR832
- Greece: GR115, GR127, GR212, GR214, GR221, GR223, GR224, GR231, GR243, GR244, GR245, GR252, GR254, GR411, GR412, GR413, GR421, GR422, GR432, GR433
- Italy: ITC20, ITC32, ITC44, ITD20, ITD33, ITF11, ITF21, ITF35, ITF62, ITG13, ITG26, ITG29, ITG2A, ITG2C
- Latvia: LV007, LV008
- The Netherlands: NL342
- Poland: PL425
- Portugal: PT164, PT165, PT166, PT167, PT168, PT16A, PT181, PT182
- Romania: RO114, RO225, RO422
- Sweden: SE213, SE221, SE311, SE312, SE313, SE321, SE322, SE331, SE332
- United Kingdom: UKL12

From the above regions available to each cluster we attempted to select areas as to achieve a balance among the member states, large and small, new and old as well as including two regions with significant stress on water resources (step 5), two with pressure on agricultural land (step 4) and one region with pressure on both land and water. In the case of these five areas the ecological commodities model will be applied. This process resulted to the selection of 18 regions shown in Table 21. Also, it was ensured that two of the selected regions were mountainous ones. In total, 15 EU Member States (both old and new; south, central and north) were represented in the sample.

Table 21: Selected TWG2 test regions

Cluster	OECD Modified Classif.	GEO (NUTS 2006)	NUTS_0_NAME	NUTS_1_NAME	NUTS_2_NAME	NUTS_3_NAME	Main Characteristics	Type of IO Model
1	RPR	AT124	ÖSTERREICH	OSTÖSTERREICH	Niederösterreich	Waldviertel	Mountainous	Conventional
1	RPR	HU232	MAGYARORSZAG	DUNANTUL	Del-Dunantul	Somogy		Conventional
1	RAR	GR144	ELLADA	VOREIA ELLADA	Thessalia	Trikala	Mountainous, Water Stress	**Ecological commodity**
1	RAR	SK032	SLOVENSKA REPUB	SLOVENSKA REPUBLIK/	Stredne Slovensko	Banskobystricky kraj		Conventional
1	IOR	DE218	DEUTSCHLAND	BAYERN	Oberbayern	Ebersberg	Stress on Land	**Ecological commodity**
1	IOR	ITE31	ITALIA	CENTRO (I)	Marche	Pesaro e Urbino		Conventional
2	RPR	ITF52	ITALIA	SUD	Basilicata	Matera	High Importance of Agriculture, Water Stress	**Ecological commodity**
2	RPR	FR624	FRANCE	SUD-OUEST	Midi-Pyrénées	Gers	High Importance of Agriculture, High Population Growth	Conventional
2	RAR	DE22A	DEUTSCHLAND	BAYERN	Niederbayern	Rottal-Inn	High Population Growth	Conventional
2	RAR	CZ063	CESKA REPUBLIKA	CESKA REPUBLIKA	Jihovychod	Vysocina	High Importance of Agriculture	Conventional
2	IOR	ES211	ESPAÑA	NORESTE	País Vasco	Álava	High Population Growth, Stress on both Land & Water	**Ecological commodity**
2	IOR	PL214	POLSKA	REGION POLUDNIOWY	Malopolskie	Krakowski	High Importance of Agriculture, High Population Growth	Conventional
3	RPR	SE213	SVERIGE	Södra Sverige	Småland med öarna	Kalmar län	High Importance of Tourism	Conventional
3	RPR	RO422	Romania	Macroregiunea patru	Vest	Caras-Severin	High Importance of both Food Processing and Tourism	Conventional
3	RAR	UKL12	UNITED KINGDOM	WALES	West Wales and The Valleys	Gwynedd	High Importance of Tourism	Conventional
3	RAR	LV007	LATVIJA	LATVIJA	Latvija	Pieriga	High Importance of both Food Processing and Tourism	Conventional
3	IOR	NL342	NEDERLAND	WEST-NEDERLAND	Zeeland	Overig Zeeland	High Importance of both Food Processing and Tourism	Conventional
3	IOR	FR831	FRANCE	MÉDITERRANÉE	Corse	Corse-du-Sud	High Importance of both Food Processing and Tourism, Stress on Land	**Ecological commodity**
Cluster 1 (non-dynamic areas): Low/Average Importance of Agriculture, Low Importance of Food Industry, Medium Importance of Tourism, Stagnant Population								
Cluster 2 (agriculturally-dependent dynamic areas with low internal links): Imporant Agriculture, Medium Importance of Food Industry, Low Importance of Tourism, High Population Growth								
Cluster 3 (Diversified dynamic areas with high links): Medium Importance of Agriculture, High Importance of Food Industry, High Importance of Tourism, Medium to High Population Growth								

4.2 Model Construction

This section aims at summarizing the main elements of the construction of the 18 regional I/O models which are then used for carrying out the TWG2 linkage analysis.

For the purpose of this work and for constructing regional I/O Tables, the hybrid Generation of Regional I-O Tables (GRIT) has been chosen. This method has been chosen mainly because the cost of using a full survey-based method to generate regional I/O tables is prohibitive, while regional I/O tables constructed via non-survey techniques are not sufficiently accurate (Richardson, 1972). Furthermore, as noted by Johns and Leat (1987), GRIT is particularly suitable even to smaller regions, as it enables the more accurate estimation of the (expectedly) smaller multipliers that characterise small regional economies. Within this context, GRIT can be applied to the generation of regional I/O tables even for NUTS4 or NUTS5 areas.

As a starting point, GRIT requires a national I/O table. Thus, national I/O tables were obtained from the Eurostat data base for all countries corresponding to the 18 test regions (with the exception of the UK table which was provided by the OECD). Table 22 below summarises the base year of each national I/O table, which corresponds to the base years of the country-specific constructed regional I/O tables. As seen from the Table, more than half of national I/O tables corresponded to either 2005 or 2004. Also, seven of the national I/O tables were recorded in Euros and the rest in national currencies.

The main data requirements for GRIT are a national I/O table and sectoral employment data at the national and regional levels. The availability of this data "guarantees" the construction of a "mechanical" regional I/O table. Thus, as a next step, GRIT generates an initial regional transactions matrix by using employment-based Simple Location Quotients (SLQ) and Cross Industry Location Quotients (CILQ) to adjust "mechanically" the national direct requirements matrix. The data which should be available to perform these estimations includes NACE 2-digit sectoral employment at the national and regional level, respectively. Obtaining this data for 18 areas has proved to be a very difficult and time-consuming task, as this data (at least at the NUTS3 level) is not publicly available. The research team has managed to obtain this data and construct regional IO tables for 17 out of 18 study areas, as our efforts were not successful in the case of the region of Krakowski in Poland.

Table 22: National I/O Tables utilized for TWG2 analysis

Country	Base-Year	Currency
Austria	2005	Ml. Euro
Hungary	2000	Ml. HUF
Greece	2004	Ml. Euro
Slovakia	2000	Ml. SK
Germany	2005	Ml. Euro
Italy	2000	Ml. Euro
France	2005	Ml. Euro
Czech Republic	2005	Ml. CZK
Spain	2000	Ml. Euro
Poland	2000	Ml. PLN
Sweden	2005	Ml. SEK
Romania	2000	Ml. RON
UK	2004	Ml. GBP
Latvia	1998	Ths. Lats
The Netherlands	2004	Ml. Euro

Further, as in the case of several relevant research efforts (e.g. Doyle et al., 1997; Mattas, 2001), time constraints did not allow the fulfilment of business surveys and thus, the insertion of superior data to the constructed regional I/O tables.

Finally, in the case of the five areas where interdependence analysis is carried out (also) through the use of an ecological commodity I/O model, the generation of ecological commodity inputs (for water and land) was carried out as follows:

Water Abstraction

Regional water needs by sector are deduced by national data provided for by Eurostat's environment database at the following address:

http://epp.eurostat.ec.europa.eu/portal/page/portal/environment/data/database

The database provides national data on annual water abstraction by source and sector at million m^3 at the following address:

http://nui.epp.eurostat.ec.europa.eu/nui/show.do?dataset=env_watq2_1&lang=en

From this database one can get the following variables per member state and available year:

WA_1_2_1	Abstraction by agriculture, for irrigation purposes
WA_1_3	Abstraction by mining and quarrying
WA_1_4	Abstraction by manufacturing industry (total)
WA_1_4_1	Abstraction by manufacturing industry, for food processing industry
WA_1_4_2	Abstraction by manufacturing industry, for cooling purposes
WA_1_5	Abstraction by production of electricity, for cooling purposes
WA_1_6	Abstraction by other activities
WA_1_7	Abstraction by construction
WA_1_8	Abstraction by households

Thus, for our purposes we can have an estimate of the annual national water abstraction for agriculture, the whole of the manufacturing industry, electricity and construction. For agriculture, electricity and construction the regionalization may be performed by taking a regional share of the national figure. For agriculture, the regional annual water abstraction figure is estimated by the region's share of irrigated land as this is estimated by the 2003 or 2005 Agricultural Structures Surveys. Thus, prefecture's i water abstraction is estimated as:

$$\frac{\text{Total Irrigated Land in Region i}}{\text{Total Irrigated Land in Nation}} \, x \, \text{Annual Water Abstraction by Agriculture in Nation}$$

Similarly, the annual water abstraction for region i by manufacturing industry, electricity and construction may be estimated as:

$$\frac{\text{Total Employment in Manufacturing (construction, electricity) in Region i}}{\text{Total Employment in Manufacturing (construction, electricity) in Nation}}$$
$$x \, \text{Annual Water Abstraction by Manufacturing (construction, electricity) in Nation}$$

For manufacturing, however, one more step should be taken in order to allocate the estimated annual regional water abstraction by all manufacturing industries to each one of the industries used by the I-O table. This can be done by allocating the estimated water abstraction according to each industry's expenditures for electricity and water as follows:

$$\frac{\text{Expenditures by Manufacturing Industry i for Water}}{\text{Expenditures by All Manufacturing Industries for Water}} x$$

$$\textit{Total}\ \text{Water Abstraction by Manufacturing in Region}$$

Land Use

Estimates of regional land use are based on the European LEAC (Land and Ecosystem Accounts). LEAC provides the land stock available for each land cover class and provides also the changes occurred between 1990 and 2000. LEAC data are available for various spatial units (NUTS 3, NUTS2, and national level). Of importance to our study are the land cover classes:

Artificial Surfaces (1), including industrial or commercial units (121), Road and rail networks and associated land (122), Ports (123) and Airports (124), Mineral extraction (131) and

Agricultural areas (2)

Because land use data are directly available for different regional units there is no need to regionalize national data. Data for agriculture, mining, transportation, etc. can be used directly in the I-O tables. The only task is to allocate the land devoted to industrial or commercial units to the various manufacturing sectors. One way of achieving this will be to take regional employment shares and assume that land allocation among manufacturing industries follows the employment allocation.

5 Results

5.1 Regional Analysis

The aim of this section is to analytically present study-area-specific results on the investigation of links between agriculture and the rest of the economy in terms of:

i. provision of non-agricultural goods and services to the farm sector;

ii. use of farm output in the rest of the economy;

iii. supply and demand for production factors, and

iv. potential for diversification of farm activities.

These results are presented in Tables 23 to 30. Tables 23, 24 and 25 present the linkages between agriculture and the rest of the economy in the 17 study regions. Then, the following three tables present the respective linkages of sectors which in certain study areas have been found to have important forward links with agriculture, i.e. Food Processing (Table 26), Trade (Table 27) and Hotels and Catering (Table 28). The last two Tables (29 and 30) present direct and indirect sectoral water and land consumption in a total of five study areas facing pressure for these two resources.

Table 23: Links of Agriculture with the rest of the Economy, Non-Dynamic Areas						
	Waldviertel (AU) - RPR -15 sectors	Somogy (HU) - RPR - 15 sectors	Trikala (GR) - RAR - 15 sectors	Banska Bystricka (SK) - RAR - 13 sectors	Ebersberg (DE) - IOR - 13 sectors	Pesaro & Urbino (IT) - IOR - 13 sectors
A. Provision of non-agricultural goods and services to the farm sector						
Bacward Linkage	1.204 (15)	1.546 (13)	1.273 (14)	1.834 (11)	1.637 (10)	1.323 (8)
indirect effects	0.196 (15)	0.526 (13)	0.242 (14)	0.782 (11)	0.625 (10)	0.321 (8)
Most Important Backward	Manuf. (0.07)	Manuf. (0.20)	Trade (0.064)	Manuf. (0.405)	Manuf. (0.159)	Manuf. (0.151)
Backward Dispersion	0.691 (15)	0.865 (13)	0.667 (14)	0.913 (11)	0.823 (10)	0.947 (8)
Backward Interconn.	2.245 (15)	5.016 (12)	2.583 (14)	5.005 (11)	4.846 (11)	2.771 (8)
Output Elasticity	0.039 (11)	0.060 (9)	0.092 (8)	0.053 (6)	0.029 (11)	0.004 (13)
Income Elasticity	0.062 (8)	0.073 (6)	0.111 (6)	0.039 (8)	0.045 (9)	0.005 (13)
B. Use of farm output in the rest of the economy						
Forward Linkage	1.855 (9)	1.377 (8)	2.589 (4)	2.294 (2)	2.589 (7)	2.934 (7)
indirect effects	0.847 (7)	0.370 (8)	1.533 (4)	1.241 (1)	1.577 (7)	1.922 (4)
Forward Food Industry	0.018 (14)	0.038 (3)	0.272 (2)	0.059 (6)	0.002 (13)	0.030 (12)
Forward Trade	0.075 (3)	0.030 (4)	0.201 (3)	0.134 (3)	0.032 (10)	0.368 (3)
Forward Hotels & Catering	0.037 (10)	0.013 (7)	0.118 (5)	0.018 (13)	0.042 (9)	0.368 (3)
Forward Dispersion	1.052 (9)	0.955 (8)	1.247 (4)	1.294 (2)	0.978 (8)	1.197 (7)
C. Supply and demand for production factors						
Value Added Index	0.107 (15)	0.380 (12)	0.253 (13)	0.719 (7)	0.125 (11)	0.971 (7)
Value Added Multiplier	0.062 (15)	0.047 (12)	0.118 (13)	0.104 (7)	0.018 (11)	0.769 (7)
Cumulated PI for Empl.	0.017 (14)	0.088 (12)	0.062 (12)	0.210 (9)	0.116 (12)	0.014 (13)
Employment Elasticity	0.034 (11)	0.052 (8)	0.079 (8)	0.047 (8)	0.034 (11)	0.003 (13)
Ghosh Multiplier	1.841 (8)	1.728 (10)	2.450 (5)	2.223 (2)	1.951 (9)	2.897 (3)
D. Potential for diversification of farm activities						
Forward Interconn.	4.120 (7)	4.840 (7)	6.079 (4)	4.879 (13)	2.947 (9)	0.697 (10)
Source:Authors' calculation (figures in parentheses are sectoral rankings; red = low, black = average, green = high)						

Table 24: Links of Agriculture with the rest of the Economy, Agriculturally-dependent, Dynamic Areas					
	Matera (IT) - RPR - 13 sectors	Gers (FR) - RPR - 15 sectors	Rottal - Inn (DE) - RAR - 12 sectors	Vysocina (CZ) - RAR - 16 sectors	Alava (ES) - IOR - 10 sectors
A. Provision of non-agricultural goods and services to the farm sector					
Bacward Linkage	1.293 (8)	1.392 (15)	1.660 (8)	1.466 (14)	1.680 (8)
indirect effects	0.287 (8)	0.358 (15)	0.651 (7)	0.437 (14)	0.672 (8)
Most Important Backward	Manuf. (0.116)	Food Proc. (0.073)	Manuf. (0.254)	Manuf. (0.196)	Manuf. (0.299)
Backward Dispersion	0.931 (8)	0.676 (15)	0.276 (4)	0.836 (14)	0.853 (8)
Backward Interconn.	2.56 (8)	4.373 (15)	4.810 (4)	4.056 (14)	3.627 (8)
Output Elasticity	0.014 (13)	0.092 (7)	0.010 (11)	0.078 (3)	0.009 (10)
Income Elasticity	0.018 (13)	0.081 (15)	0.015 (11)	0.076 (3)	0.007 (10)
B. Use of farm output in the rest of the economy					
Forward Linkage	2.712 (6)	2.234 (7)	1.640 (1)	1.659 (9)	1.724 (1)
indirect effects	1.684 (5)	1.188 (6)	0.636 (1)	0.630 (10)	0.719 (1)
Forward Food Industry	0,040 (12)	0.307 (2)	0.040 (3)	0.016 (11)	0.068 (3)
Forward Trade	0.318 (3)	0.147 (4)	0.010 (8)	0.041 (4)	0.061 (4)
Forward Hotels & Catering	0.318 (3)	0.066 (8)	0.016 (7)	0.017 (10)	0.061 (4)
Forward Dispersion	1.184 (6)	1.092 (7)	1.278 (1)	0.948 (9)	1.332 (1)
C. Supply and demand for production factors					
Value Added Index	0.956 (10)	0.439 (11)	0.073 (11)	0.271 (13)	0.047 (10)
Value Added Multiplier	0.751 (10)	0.058 (11)	0.010 (11)	0.602 (13)	0.009 (10)
Cumulated PI for Empl.	0.035 (12)	0.088 (15)	0.113 (11)	0.104 (6)	0.144 (8)
Employment Elasticity	0.012 (13)	0.118 (9)	0.011 (11)	0.069 (3)	0.015 (10)
Ghosh Multiplier	2.638 (4)	2.057 (8)	2.176 (3)	1.612 (9)	2.098 (4)
D. Potential for diversification of farm activities					
Forward Interconn.	1.63 (8)	6.310 (4)	3.852 (10)	5.44 (4)	1.392 (10)
Source:Authors' calculation (figures in parentheses are sectoral rankings; red = low, black = average, green = high)					

Table 25: Links of Agriculture with the rest of the Economy, Diversified Dynamic Areas						
	Kalmar Ian (SE) - RPR - 15 sectors	Caras Severin (RO) - RPR - 15 sectors	Gwynedd (UK) - RAR - 10 sectors	Pieriga (LV) - RAR - 14 sectors	Overig Zeeland (NL) - IOR - 14 sectors	Corse-du-Sud (FR) - IOR - 15 sectors
A. Provision of non-agricultural goods and services to the farm sector						
Bacward Linkage	1.233 (13)	1.649 (14)	1.687 (8)	1.389 (14)	1.417 (12)	1.634 (12)
indirect effects	0.225 (12)	0.585 (13)	0.634 (8)	0.304 (14)	0.390 (12)	0.618 (10)
Most Important Backward	Manuf. (0.066)	Manuf. (0.239)	Manuf. (0.196)	Manuf. (0.114)	Food Proc. (0.101)	Real Estate (0.212)
Backward Dispersion	0.857 (13)	0.816 (14)	0.961 (8)	0.740 (14)	0.813 (12)	2.749 (1)
Backward Interconn.	4.29 (11)	4.38 (13)	3.05 (7)	3.821 (14)	4.436 (12)	5.357 (11)
Output Elasticity	0.022 (11)	0.098 (4)	0.081 (5)	0.246 (2)	0.047 (11)	0.010 (14)
Income Elasticity	0.029 (10)	0.104 (3)	0.069 (5)	0.262 (2)	0.065 (11)	0.015 (12)
B. Use of farm output in the rest of the economy						
Forward Linkage	2.237 (5)	2.735 (3)	2.747 (7)	1.111 (10)	1.440 (3)	2.749 (1)
indirect effects	1.214 (5)	1.642 (3)	1.623 (6)	0.109 (10)	0.423 (3)	1.728 (1)
Forward Food Industry	0.191 (3)	0.057 (11)	0.046 (9)	0.003 (7)	0.354 (2)	0.516 (2)
Forward Trade	0.110 (4)	0.119 (5)	0.272 (3)	0.010 (3)	0.004 (8)	0.142 (5)
Forward Hotels & Catering	0.035 (8)	0.056 (12)	0.272 (3)	0.002 (8)	0.026 (3)	0.160 (4)
Forward Dispersion	1.131 (5)	1.252 (3)	1.120 (6)	0.839 (11)	1.159 (3)	0.875 (12)
C. Supply and demand for production factors						
Value Added Index	0.555 (11)	0.013 (8)	0.159 (6)	1.563 (4)	0.226 (13)	0.092 (13)
Value Added Multiplier	0.251 (11)	0.101 (8)	0.002 (6)	0.202 (4)	0.030 (13)	0.011 (13)
Cumulated PI for Empl.	0.046 (11)	0.107 (6)	0.137 (7)	0.194 (8)	0.055 (13)	0.098 (13)
Employment Elasticity	0.025 (11)	0.069 (3)	0.086 (5)	0.247 (2)	0.049 (11)	0.009 (13)
Ghosh Multiplier	2.188 (4)	2.502 (5)	2.450 (4)	1.906 (5)	1.729 (6)	2.557 (1)
D. Potential for diversification of farm activities						
Forward Interconn.	4.800 (7)	6.290 (2)	2.610 (6)	6.477 (2)	4.733 (7)	3.694 (9)
Source:Authors' calculation (figures in parentheses are sectoral rankings; red = low, black = average, green = high)						

Table 26: Links of Food Processing with the rest of the Economy							
	Trikala (GR) - RAR - 15 sectors	Gers (FR) - RPR - 15 sectors	Rottal - Inn (DE) - RAR - 12 sectors	Alava (ES) - IOR - 10 sectors	Kalmar lan (SE) - RPR - 15 sectors	Overig Zeeland (NL) - IOR - 14 sectors	Corse-du-Sud (FR) - IOR - 15 sectors
A. Provision of goods and services to the food processing sector							
Bacward Linkage	1.704 (9)	1.869 (12)	1.644 (9)	1.798 (6)	1.463 (7)	1.635 (10)	1.883 (7)
indirect effects	0.655 (8)	0.800 (12)	0.620 (9)	0.781 (6)	0.456 (6)	0.591 (10)	0.845 (7)
Most Important Backward	Agriculture	Agriculture	Trade	Financial	Agriculture	Agriculture	Real Estate
Bacward Agriculture	0.265	0.288	0.026	0.046	0.173	0.233	0.177
Backward Dispersion	0.893 (8)	0.907 (12)	0.266 (8)	0.914 (6)	1.017 (7)	0.939 (10)	2.597 (3)
Backward Interconn.	4.659 (7)	5.702 (11)	5.053 (7)	3.841 (6)	5.11 (9)	5.133 (11)	5.841 (9)
Output Elasticity	0.121 (5)	0.154 (3)	0.050 (7)	0.032 (9)	0.040 (6)	0.123 (6)	0.066 (8)
Income Elasticity	0.137 (5)	0.191 (2)	0.051 (7)	0.044 (7)	0.062 (6)	0.145 (5)	0.087 (6)
B. Use of output in the rest of the economy							
Forward Linkage	2.746 (2)	2.581 (3)	1.126 (6)	1.273 (4)	2.490 (2)	1.161 (9)	2.597 (3)
indirect effects	1.652 (2)	1.483 (3)	0.125 (6)	0.269 (4)	1.452 (2)	0.143 (9)	1.540 (2)
Forward Trade	0.240 (3)	0.237 (3)	0.010 (5)	0.059 (2)	0.053 (3)	0.004 (7)	0.186 (4)
Forward Hotels & Catering	0.217 (4)	0.125 (7)	0.017 (3)	0.059 (2)	0.008 (13)	0.050 (2)	0.206 (3)
Forward Dispersion	1.322 (2)	1.261 (3)	0.878 (6)	0.984 (4)	1.259 (2)	0.934 (9)	1.009 (7)
C. Supply and demand for production factors							
Value Added Index	0.432 (10)	0.658 (8)	0.450 (8)	0.114 (9)	0.491 (12)	0.425 (11)	0.336 (12)
Value Added Multiplier	0.201 (11)	0.087 (8)	0.062 (8)	0.022 (9)	0.222 (12)	0.057 (11)	0.040 (12)
Cumulated PI for Empl.	0.089 (5)	0.138 (12)	0.127 (10)	0.134 (10)	0.047 (12)	0.078 (12)	0.145 (11)
Employment Elasticity	0.323 (1)	0.160 (2)	0.038 (8)	0.044 (7)	0.052 (7)	0.111 (4)	0.094 (5)
Ghosh Multiplier	2.510 (3)	2.314 (3)	1.684 (7)	2.154 (3)	2.340 (2)	1.611 (7)	2.356 (3)
D. Potential for diversification							
Forward Interconn.	5.917 (5)	6.666 (3)	6.188 (8)	2.365 (6)	5.55 (5)	5.798 (3)	5.356 (5)
Source:Authors' calculation (figures in parentheses are sectoral rankings; red = low, black = average, green = high)							

Table 27: Links of Trade with the rest of the Economy											
	Waldviertel (AU) - RPR -15 sectors	Trikala (GR) - RAR - 15 sectors	Banska Bystricka (SK) - RAR - 13 sectors	Pesaro & Urbino (IT) -IOR - 13 sectors*	Matera (IT) - RPR - 13 sectors*	Gers (FR) - RPR - 15 sectors	Alava (ES) - IOR - 10 sectors*	Kalmar lan (SE) - RPR - 15 sectors	Gwynedd (UK) - RAR - 10 sectors*	Pieriga (LV) - RAR - 14 sectors	Corse-du-Sud (FR) - IOR - 15 sectors
A. Provision of goods and services to the trade sector											
Bacward Linkage	1.874 (5)	1.711 (8)	2.172 (5)	1.593 (3)	1.667 (1)	2.205 (5)	2.150 (4)	1.417 (9)	1.929 (2)	2.004 (4)	2.091 (5)
indirect effects	0.749 (6)	0.610 (11)	1.084 (6)	0.562 (3)	0.631 (2)	1.062 (6)	0.982 (4)	0.405 (7)	0.804 (4)	0.895 (5)	1.002 (4)
Most Important Backward	Manuf. (0.179)	Transp. (0.083)	Manuf. (0.438)	Manuf. (0.22)	Manuf. (0.198)	Real Estate (0.473)	Manuf. (0.412)	Manuf. (0.120)	Manuf. (0.276)	Manuf. (0.271)	Real Estate (0.535)
Bacward Agriculture	0.032	0.070	0.065	0.011	0.028	0.080	0.016	0.010	0.052	0.161	0.015
Backward Dispersion	1.076 (5)	0.897 (7)	1.080 (5)	1.139 (2)	1.200 (1)	1.070 (5)	1.092 (4)	0.985 (9)	1.099 (2)	1.067 (4)	2.267 (4)
Backward Interconn.	4.799 (7)	4.394 (11)	5.363 (6)	3.777 (3)	3.99 (2)	6.292 (8)	4.090 (5)	5.43 (7)	3.30 (5)	5.501 (8)	6.281 (4)
Output Elasticity	0.151 (2)	0.171 (2)	0.148 (2)	0.190 (2)	0.186 (2)	0.201 (2)	0.207 (2)	0.096 (3)	0.203 (2)	0.177 (3)	0.144 (3)
Income Elasticity	0.134 (2)	0.167 (2)	0.045 (3)	0.212 (2)	0.212 (2)	0.122 (9)	0.157 (4)	0.111 (3)	0.152 (4)	0.179 (3)	0.120 (4)
B. Use of output in the rest of the economy											
Forward Linkage	2.058 (5)	2.332 (6)	1.893 (6)	3.123 (4)	2.791 (5)	2.443 (6)	1.196 (6)	2.200 (6)	2.816 (5)	1.300 (7)	2.267 (5)
indirect effects	0.933 (5)	1.158 (6)	0.805 (7)	1.767 (6)	1.524 (8)	1.239 (5)	0.187 (6)	1.074 (7)	1.559 (6)	0.284 (7)	1.125 (5)
Forward Hotels & Catering	0.046 (10)	0.104 (6)	0.020 (11)	-	-	0.074 (8)	-	0.034 (9)	-	0.007 (11)	0.104 (5)
Forward Dispersion	1.167 (6)	1.123 (6)	1.067 (6)	1.274 (4)	1.218 (5)	1.194 (6)	0.924 (6)	1.112 (7)	1.148 (5)	0.981 (7)	1.120 (5)
C. Supply and demand for production factors											
Value Added Index	1.058 (5)	0.783 (8)	1.844 (2)	0.952 (9)	1.005 (7)	2.588 (2)	1.681 (3)	1.252 (7)	0.234 (4)	1.730 (3)	2.084 (2)
Value Added Multiplier	0.613 (5)	0.365 (8)	0.266 (2)	0.754 (9)	0.789 (7)	0.343 (2)	0.322 (3)	0.565 (7)	0.040 (4)	0.223 (3)	0.248 (2)
Cumulated PI for Empl.	0.215 (2)	0.234 (2)	0.303 (3)	0.263 (2)	0.241 (3)	0.316 (1)	0.369 (3)	0.243 (3)	0.277 (2)	0.230 (2)	0.318 (2)
Employment Elasticity	0.129 (3)	0.180 (3)	0.053 (5)	0.165 (2)	0.162 (2)	0.123 (8)	0.178 (2)	0.261 (2)	0.189 (4)	0.150 (3)	0.110 (4)
Ghosh Multiplier	1.830 (8)	1.986 (7)	1.797 (7)	2.304 (8)	2.202 (8)	2.111 (5)	2.157 (2)	1.954 (9)	2.240 (7)	2.130 (5)	1.999 (5)
D. Potential for diversification											
Forward Interconn.	6.270 (2)	6.341 (1)	6.480 (12)	4.185 (3)	4.06 (2)	6.704 (2)	4.301 (3)	6.35 (3)	4.00 (2)	6.193 (3)	6.120 (2)

* Trade and Hotels & Catering as one sector

Source:Authors' calculation (figures in parentheses are sectoral rankings; red = low, black = average, green = high)

Table 28: Links of Hotels & Catering with the rest of the Economy						
	Trikala (GR) - RAR - 15 sectors	Pesaro & Urbino (IT) - IOR - 13 sectors*	Matera (IT) - RPR - 13 sectors*	Alava (ES) - IOR - 10 sectors*	Gwynedd (UK) - RAR - 10 sectors*	Corse-du-Sud (FR) - IOR - 15 sectors
A. Provision of goods and services to the hotels & catering sector						
Bacward Linkage	1.687 (10)	1.593 (3)	1.667 (1)	2.150 (4)	1.929 (2)	1.882 (7)
indirect effects	0.633 (10)	0.562 (3)	0.631 (2)	0.982 (4)	0.804 (4)	0.808 (8)
Most Important Backward	Food Proc. (0.176)	Manuf. (0.22)	Manuf. (0.198)	Manuf. (0.412)	Manuf. (0.276)	Real Estate (0.388)
Bacward Agriculture	0.093 (4)	0.011 (9)	0.028 (7)	0.016	0.052 (6)	0.029
Backward Dispersion	0.884 (10)	1.139 (2)	1.200 (1)	1.092 (4)	1.099 (2)	2.663 (2)
Backward Interconn.	4.574 (9)	3.777 (3)	3.99 (2)	4.090 (5)	3.30 (5)	6.021 (8)
Output Elasticity	0.135 (4)	0.190 (2)	0.186 (2)	0.207 (2)	0.203 (2)	0.106 (5)
Income Elasticity	0.159 (3)	0.212 (2)	0.212 (2)	0.157 (4)	0.152 (4)	0.090 (5)
B. Use of output in the rest of the economy						
Forward Linkage	2.873 (1)	3.123 (4)	2.791 (5)	1.196 (6)	2.816 (5)	2.663 (2)
indirect effects	1.768 (1)	1.767 (6)	1.524 (8)	0.187 (6)	1.559 (6)	1.539 (2)
Forward Dispersion	1.384 (1)	1.274 (4)	1.218 (5)	0.924 (6)	1.148 (5)	1.008 (8)
C. Supply and demand for production factors						
Value Added Index	0.421 (12)	0.952 (9)	1.005 (7)	1.681 (3)	0.234 (4)	1.300 (6)
Value Added Multiplier	0.196 (12)	0.754 (9)	0.789 (7)	0.322 (3)	0.040 (4)	0.154 (6)
Cumulated PI for Empl.	0.089 (5)	0.263 (2)	0.241 (3)	0.369 (3)	0.277 (2)	0.230 (9)
Employment Elasticity	0.149 (5)	0.165 (2)	0.162 (2)	0.178 (2)	0.189 (4)	0.083 (7)
Ghosh Multiplier	2.599 (1)	2.304 (8)	2.202 (8)	2.157 (2)	2.240 (7)	2.350 (3)
D. Potential for diversification						
Forward Interconn.	5.975 (4)	4.185 (3)	4.06 (2)	4.301 (3)	4.00 (2)	5.899 (4)
* Trade and Hotels & Catering as one sector						
Source:Authors' calculation (figures in parentheses are sectoral rankings; red = low, black = average, green = high)						

Table 29: Direct and Indirect Water Consumption (cubic metres per ml Euros)			
	Trikala (GR) - RAR - 15 sectors	Matera (IT) - RPR - 13 sectors	Alava (ES) - IOR - 10 sectors
Agriculture Total	911742	6641155	1122045
Agriculture Indirect	0.10%	0.05%	0.35%
Manufacturing	31884	340512	27395
Food Processing	236982	162625	65689
Public Administration	142853	36773	35833
Hotels & Catering	93591	198453	36391
Source:Authors' calculation			

Table 30: Direct and Indirect Land Consumption (hectares per ml Euros)			
	Ebersberg (DE) - IOR - 13 sectors	Alava (ES) - IOR - 10 sectors	Corse-du-Sud (FR) - IOR - 15 sectors
Agriculture Total	281,08	1965,91	544,7
Agriculture Indirect	0.01%	0.01%	0.02%
Manufacturing	10,42	38,7	7,37
Food Processing	11,49	90,93	95,01
Public Administration	10,83	33,32	12,79
Hotels & Catering	9,08	32,02	15,88
Source:Authors' calculation			

5.1.1 Cluster 1: Non-Dynamic Areas

Waldviertel (AU) – Rural Peripheral Region (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates low knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector.

iii) Taking into account average sector sizes, agricultural effects are characterised as very low (backward dispersion index of 0.691)

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also very low (backward interconnectedness index is 2.245).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output are low (elasticity of 0.039), while those on income are moderate (0.062).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are moderate.

ii) In more detail, forward links between agriculture and the local Food and Hotels and Catering sectors are low; however, local agriculture seems to have rather high forward links with the local Trade sector.

iii) More important, the Trade sector in Waldviertel is found to possess very high backward and forward links with the rest of the economy (with the exception of effects associated with demand for capital and labour supply). In other words, an increase in demand for the output of Trade generates important economy-wide effects for local output and production factors (Table 27).

iv) Compared to other sectors, forward links of local agriculture are ranked as average, but it seems that farming is a key sector in terms of forward links (forward dispersion index of 1.052).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are also estimated as low (cumulated primary input coefficient for employment of 0.017). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.034).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 1.841).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively high (forward interconnectedness index of 4.120).

Somogy (HU) – Rural Peripheral Region (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) As in the case of Waldviertel, an increase in agricultural output generates low knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector.

iii) Taking into account average sector sizes, agricultural effects are characterised as low (backward dispersion index of 0.865)

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also comparatively low (backward interconnectedness index I s 5.016).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output are average (elasticity of 0.060), while those on income are rather high (0.073).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are rather high (forward linkage of 1.377) in direct and indirect terms.

ii) In more detail, forward links between agriculture and the local Food and Trade sectors are of average size, while local agriculture seems to have rather low forward links with the local Hotels and Catering sector.

iii) Compared to other sectors, forward links of local agriculture are ranked as average (forward dispersion index of 0.955).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are also estimated as low (cumulated primary input coefficient for employment of 0.088). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.052).

iii) A unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates comparatively moderate knock-on effects for this local economy (multiplier of 1.728).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively average (forward interconnectedness index of 4.840).

Trikala (GR) – Rural Accessible Region (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) As in the case of the previous two regions, an increase in agricultural output generates low knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) The most important knock-on effects associated with local agriculture are found in the Trade sector.

iii) Taking into account average sector sizes, agricultural effects are characterised as very low (backward dispersion index of 0.667)

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also very low (backward interconnectedness index is 2.583).

v) However, if the relative size of local agriculture is taken into account, effects of local farming on local output are comparatively average (elasticity of 0.092), while those on income are quite high (0.111).

B. Use of farm output in the rest of the economy

i) All forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are very high (e.g. forward linkage of 2.589; indirect linkage of 1.533).

ii) In more detail, forward links between agriculture and the local Food (0.272), Trade (0.201) and Hotels and Catering (0.118) sectors are quite high.

iii) More important, all these three sectors characterised by their high links with local farming (Tables 26-28), exhibit very high backward and forward links with the rest of the economy (with the exception of effects associated with demand for capital for Food Processing and labour supply for Hotels and Catering). In other words, an increase in demand for the output of these three sectors generates important economy-wide effects.

iv) Compared to other sectors, forward links of local agriculture are ranked as very high, as farming is a key sector in terms of forward links (forward dispersion index of 1.247).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as low, both directly and indirectly (value added index and multiplier).

ii) direct and indirect effects of farm activity on local wages and salaries (demand for labour) are also estimated as low (cumulated primary input coefficient for employment of 0.062). However, if the relative size of the sector is taken into account effects become comparatively average (employment elasticity of 0.079).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.450).

iv) Direct and indirect water consumption (cubic metres per one ml Euro of output) by local agriculture is (compared to that of other regions investigated in this report) rather low (Table 29). Direct consumption associated with farm output represents 99.90% of total consumption. On the other hand, water consumption by other sectors such as Food Processing, Public Administration and Hotels and Catering is rather high.

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as very high (forward interconnectedness index of 6.079).

Banska Bystricka (SK) – Rural Accessible Region (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) In contrast to the previous three areas, an increase in agricultural output generates comparatively average knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector and are in fact very high (0.405).

iii) Taking into account average sector sizes, agricultural effects are characterised as average (backward dispersion index of 0.913) as farming seems to be close to a "key sector" status.

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also comparatively average (backward interconnectedness index is 5.005).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output are low (elasticity of 0.053), while those on income are moderate (0.039).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are very high (forward linkage of 2.294; very high indirect effects).

ii) At the sectoral level, forward links between agriculture and Trade are very high (0.134), while links of farming with Food Processing are average (0.059). Finally, local agriculture seems to have rather low forward links with the local Hotels and Catering.

iii) More important, the Trade sector in Banska Bystricka is found to possess very high backward and forward links with the rest of the economy (Table 27).

iv) Compared to other sectors, forward links of local agriculture are ranked as very high, as farming is a key sector in terms of forward links (forward dispersion index of 1.294).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as moderate to high, both directly and indirectly (value added index and multiplier).

ii) direct and indirect effects of farm activity on local wages and salaries (demand for labour) are also estimated as moderate (cumulated primary input coefficient for employment of 0.210). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.047).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates comparatively high knock-on effects for this local economy (multiplier of 2.223).

D. Potential for diversification of farm activities

vi) The extent of diversification of farm activities is considered as of low size (forward interconnectedness index of 4.879).

Ebersberg (DE) – Intermediate Open Space (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) As in the case of the Slovakian study area, an increase in agricultural output generates comparatively average knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector.

iii) Taking into account average sector sizes, agricultural effects are characterised as average (backward dispersion index of 0.823).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also average (backward interconnectedness index is 4.846).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output are low (elasticity of 0.029), while those on income are moderate (0.045).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are moderate.

ii) However, forward links between agriculture, and the local Food, Trade and Hotels and Catering sectors are low.

iii) Compared to other sectors, forward links of local agriculture are ranked as average, but it seems that farming is close to the "key sector" status (forward dispersion index of 0.978).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are also comparatively low (cumulated primary input coefficient for employment of 0.116). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.034).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates average (in size) knock-on effects for this local economy (multiplier of 1.951).

iv) Direct and indirect land consumption (hectares per one ml Euro of output) by local agriculture is (compared to that of other regions investigated in this report) low (Table 30). Direct consumption associated with farm output represents 99.99% of total consumption. Also, land consumption by other sectors such as Food Processing, Public Administration and Hotels and Catering is also low.

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as average (forward interconnectedness index of 2.947).

Pesaro-Urbino (IT) – Intermediate Open Space (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) As in the case of Ebersberg, an increase in agricultural output generates comparatively average knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) most important knock-on effects associated with local agriculture are found in the Manufacturing sector.

iii) Taking into account average sector sizes, agricultural effects are characterised as average (backward dispersion index of 0.947); however, local farming seems close to a "key sector" status.

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also average (backward interconnectedness index is 2.771).

v) On the other hand, if the relative size of local agriculture is taken into account, effects of local farming on local output and income are low (output and income elasticities of 0.004 and 0.005, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are comparatively quite high (both total and especially, indirectly).

ii) Forward links between agriculture and the local Food sector are low (0.030), but those between agriculture and the Trade - Hotels and Catering sector (one sector in the Pesaro and Urbino IO table) are very high.

iii) More important, the Trade – Hotels and Catering sector (Table 27) in Pesaro and Urbino is found to possess very high backward and forward links with the rest of the economy (in all categories).

iv) Compared to other sectors, forward links of local agriculture are ranked as high, and farming is a key sector in terms of forward links (forward dispersion index of 1.197).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as comparatively moderate, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) seem to be rather low (cumulated primary input coefficient for employment of 0.014). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.003).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.897).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively low (forward interconnectedness index of 0.697).

5.1.2 Cluster 2: Agriculturally-dependent, Dynamic areas

<u>Matera (IT) – Rural Peripheral Region (refined OECD classification)</u>

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates rather mixed (but rather average) knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages are average; indirect linkages are low).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector.

iii) On the other hand, taking into account average sector sizes, agricultural effects are characterised as rather high (backward dispersion index of 0.931).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also of an average size (interconnectedness index is 2.560).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income are low (elasticities of 0.014 and 0.018, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are comparatively high, both in global (2.712) and indirect (1.684) terms.

ii) In more detail, forward links between agriculture and the local Food Processing sector are low (0.040). However, local agriculture seems to have rather high forward links with the local Trade – Hotels and Catering sector (one sector in the Matera IO table).

iii) More important, the Trade - Hotels and Catering sector in Matera (Table 27) is characterized by its very high backward and forward links with the rest of the economy (with the exception of effects associated with demand for capital).

iv) Compared to other sectors, forward links of local agriculture are ranked as high, as farming is a key sector in terms of forward links (forward dispersion index of 1.184).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as average, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are comparatively low (cumulated primary input coefficient for employment of 0.035). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.012).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.638).

iv) Direct and indirect water consumption (cubic metres per one ml Euro of output) by local agriculture is (compared to that of other regions investigated in this report) extremely high (Table 29). Direct consumption associated with farm output represents 99.95% of total consumption. On the other hand, water consumption by other sectors such as Manufacturing, Food Processing, and Hotels and Catering is also very high.

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively moderate (forward interconnectedness index of 1.630).

Gers (FR) – Rural Peripheral Region (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates very small knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy.

ii) The most important knock-on effects associated with local agriculture are found in the Food Processing sector.

iii) Taking into account average sector sizes, agricultural effects are also characterised as very low (backward dispersion index of 0.676).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also very limited (interconnectedness index is 4.373).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output are moderate (elasticity of 0.092), while those on local income are low (elasticity of 0.081).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are comparatively high, both in global (2.234) and indirect (1.188) terms.

ii) In more detail, forward links between agriculture and the local Food Processing and Trade sectors are very high (0.307 and 0.147, respectively). However, local agriculture seems to have rather average forward links with the Hotels and Catering sector.

iii) More important, the Food Processing (Table 26) and Trade (Table 27) sectors in Gers are characterized by quite high (in the case of Food Processing) and very significant (in the case of Trade) backward and forward links with the rest of the economy.

iv) Compared to other sectors, forward links of local agriculture are ranked as high, as farming is a key sector in terms of forward links (forward dispersion index of 1.092).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are comparatively low (cumulated primary input coefficient for employment of 0.088), but become of an average size if the relative size of the sector is taken into account (employment elasticity of 0.118).

iii) Also, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates comparatively moderate knock-on effects for this local economy (multiplier of 2.057).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as very high (forward interconnectedness index of 6.310).

Rottal-Inn (DE) – Rural Accessible Region (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates rather moderate effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages are of an average size).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector and are in fact quite high (0.254).

iii) Taking into account average sector sizes, agricultural effects are characterised as low (backward dispersion index of 0.276).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is on the other hand, high (interconnectedness index is 4.810).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income are low (elasticities of 0.010 and 0.015, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are very high, both in global (1.640) and indirect (0.636) terms.

ii) In more detail, forward links between agriculture and the local Food Processing sector are high (0.040). However, local agriculture seems to have rather low forward links with the Trade and Hotels and Catering sectors.

iii) In turn, the Food Processing sector in Rottal-Inn (Table 26) is characterized by rather satisfactory backward links with the rest of the economy.

iv) Compared to other sectors, forward links of local agriculture are ranked as very high, as farming is a key sector in terms of forward links (forward dispersion index of 1.278).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as quite low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are comparatively low (cumulated primary input coefficient for employment of 0.113). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.011).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.176).

D. Potential for diversification of farm activities

ii) The extent of diversification of farm activities is considered as comparatively limited (forward interconnectedness index of 3.852).

Vysocina (CZ) – Rural Accessible Region (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates low to moderate knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward and indirect linkages are low).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector and are in fact quite high (0.196).

iii) Also, taking into account average sector sizes, agricultural effects are characterised as rather low (backward dispersion index of 0.836).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is of an average extent (interconnectedness index is 4.056).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income are very high (elasticities of 0.078 and 0.076, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are of an average size.

ii) However, forward links between agriculture and the local Food Processing (0.016), Trade (0.041) and Hotels and Catering sector (0.017) are low.

iii) Compared to other sectors, forward links of local agriculture are ranked as average (forward dispersion index of 0.948).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as comparatively low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are of a comparatively average size (cumulated primary input coefficient for employment of 0.104), but become high if the relative size of the sector is taken into account (employment elasticity of 0.069).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates moderate knock-on effects for this local economy (multiplier of 1.612).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as very high (forward interconnectedness index of 5.44).

<u>Alava (ES) – Intermediate Open Space (refined OECD classification)</u>

A. Provision of non-agricultural goods and services to the farm sector

i) As in the case of most study regions, an increase in agricultural output generates rather mixed (low to average) knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole economy in Alava (backward linkages are average; indirect linkages are low).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector and are in fact high (0.299).

iii) Similarly, taking into account average sector sizes, agricultural effects are characterised as rather low (backward dispersion index of 0.853).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) seems quite satisfactory (interconnectedness index is 3.627).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income are low (elasticities of 0.009 and 0.007, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) in Alava are exceptionally high, both in global (1.724) and indirect (0.719) terms.

ii) In more detail, forward links between agriculture and the local Food Processing (0.068), Trade - Hotels and Catering (0.061) sectors are all high.

iii) More important, the Food Processing Sector (Table 26) in Alava has strong backward links with the rest of the economy, while Trade - Hotels and Catering (Table 27) is characterized by its very high economy-wide backward and forward links.

iv) Compared to other sectors, forward links of local agriculture are ranked as very high, as farming is a key sector in terms of forward links (forward dispersion index of 1.332).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as low (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are rather average (cumulated primary input coefficient for employment of 0.144), but turn into low if the relative size of the sector is taken into account (employment elasticity of 0.015).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.098).

iv) Direct and indirect water consumption (cubic metres per one ml Euro of output) by local agriculture is (compared to that of other regions investigated in this report) rather low (Table 29). Direct consumption associated with farm output represents 99.65% of total consumption. Also, water consumption by other sectors such as Manufacturing, Food Processing, and Hotels and Catering is comparatively low.

v) On the other hand, compared to other study regions, land consumption seems rather high. This is especially valid in the case of agriculture and secondarily in other sectors such as Manufacturing, Food Processing, Public Administration and Hotels and Catering (Table 30).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively limited (forward interconnectedness index of 1.392).

5.1.3 Cluster 3: Diversified, Dynamic areas

<u>Kalmar Lan (SE) – Rural Peripheral Region (refined OECD classification)</u>

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates comparatively low effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector and are also low (0.066).

iii) On the other hand, taking into account average sector sizes, agricultural effects are characterised as average (backward dispersion index of 0.857).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also of an average size (interconnectedness index is 4.290).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income are low (elasticities of 0.022 and 0.029, respectively).

B. Use of farm output in the rest of the economy

i) In contrast to backward effects, forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are comparatively very high, both in global (2.237) and indirect (1.214) terms.

ii) In more detail, forward links between agriculture and the local Hotels and Catering sector are low (0.035). However, local agriculture seems to have very high forward links with the local Food Processing (0.191) and Trade (0.110) sectors.

iii) More important, the Food Processing sector in Kalmar Ian (Table 26) has significant backward and forward links with the rest of the economy (with the exception of effects associated with demand for capital and labour). Also, the Trade sector (Table 27) is characterised by even more significant local interlinkages.

iv) Compared to other sectors, forward links of local agriculture are ranked as high, as farming is a key sector in terms of forward links (forward dispersion index of 1.131).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as quite low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are also comparatively low (cumulated primary input coefficient for employment of 0.046). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.025).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.188).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively moderate (forward interconnectedness index of 4.800).

<u>Caras Severin (RO) – Rural Peripheral Region (refined OECD classification)</u>

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates rather moderate effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages are average).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector and are quite high (0.239).

iii) On the other hand, taking into account average sector sizes, agricultural effects are characterised as low (backward dispersion index of 0.816).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also of an average size (interconnectedness index is 4.380).

v) However, if the relative size of local agriculture is taken into account, effects of local farming on local output and income are high (elasticities of 0.098 and 0.104, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are comparatively high, both in global (2.735) and indirect (1.642) terms.

ii) However, forward links between agriculture, Food Processing (0.057), Trade (0.119) and Hotels and Catering (0.056) are either low or average.

iii) Compared to other sectors, forward links of local agriculture are ranked as high, as farming is a key sector in terms of forward links (forward dispersion index of 1.252).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as average, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are also moderate (cumulated primary input coefficient for employment of 0.107). However, they become high if the relative size of the sector is taken into account (employment elasticity of 0.069).

iii) A unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.502).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as considerably high (forward interconnectedness index of 6.290).

<u>Gwynedd (UK) – Rural Accessible Region (refined OECD classification)</u>

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates moderate knock-on effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (backward linkages).

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector (0.196).

iii) On the other hand, taking into account average sector sizes, agricultural effects are characterised as rather moderate (backward dispersion index of 0.961); however, agriculture seems close to a "key sector" status.

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also of an average size (interconnectedness index is 3.050).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income are also average (elasticities of 0.081 and 0.069, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are comparatively moderate to high (moderate global; high indirect).

iii) In more detail, forward links between agriculture and the local Food Processing sector are rather low (0.046). However, local agriculture seems to have rather high forward links with the local Trade – Hotels and Catering sector (one sector in the Gwynedd IO table).

iv) More important, the Trade - Hotels and Catering sector in Gwynedd is characterized by its very high backward and forward links with the rest of the economy (Table 27).

v) Compared to other sectors, forward links of local agriculture are ranked as average; however, farming is a key sector in terms of forward links (forward dispersion index of 1.120).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is rather low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are comparatively low (cumulated primary input coefficient for employment of 0.137) This turns into average if the relative size of the sector is taken into account (employment elasticity of 0.086).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.450).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively limited (forward interconnectedness index of 2.610).

<u>Pieriga (LV) – Rural Accessible Region (refined OECD classification)</u>

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates very low effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy.

ii) The most important knock-on effects associated with local agriculture are found in the Manufacturing sector and is again low (0.114).

iii) Taking into account average sector sizes, agricultural effects are characterised as low (backward dispersion index of 0.740).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also of a comparatively limited extent (interconnectedness index is 3.821).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income become high (elasticities of 0.246 and 0.262, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are low to moderate, both in global (1.111) and indirect (0.109) terms.

ii) In more detail, forward links between agriculture and the local Food Processing (0.003) and Hotels and Catering (0.002) sectors are low. However, local agriculture seems to have comparative high forward links with the local Trade sector (0.010) in this very open regional economy.

iii) More important, the Trade sector in Pieriga is characterized by its very high backward and forward links with the rest of the economy (Table 27).

iv) Compared to other sectors, forward links of local agriculture are ranked as rather low (forward dispersion index of 0.839).

C. Supply and demand for production factors

i) In contrast to most study regions, the link between agricultural activity and demand for capital is estimated as comparatively high, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are comparatively high (cumulated primary input coefficient for employment of 0.194). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.247).

iii) Similarly, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 1.906).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively very high (forward interconnectedness index of 6.477).

Overig Zeeland (NL) – Intermediate Open Space (refined OECD classification)

A. Provision of non-agricultural goods and services to the farm sector

i) Similarly to most study regions, an increase in agricultural output generates rather comparatively low effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy.

ii) The most important knock-on effects associated with local agriculture are found in the Food Processing sector (0.101).

iii) Also, taking into account average sector sizes, agricultural effects are characterised as rather low (backward dispersion index of 0.813).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also comparatively limited (interconnectedness index is 4.436).

v) If the relative size of local agriculture is taken into account, effects of local farming on local output and income are also low (elasticities of 0.047 and 0.065, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are comparatively high, both in global (1.440) and indirect (0.423) terms.

ii) Forward links between agriculture and the local Food Processing sector are exceptionally high (0.354). However, local agriculture seems to have low forward links with both Trade and Hotels and Catering.

iii) More important, Food Processing (Table 26) is characterized by its satisfactory backward linkages (especially in terms of elasticity coefficients).

iv) Compared to other sectors, forward links of local agriculture are ranked as high, as farming is a key sector in terms of forward links (forward dispersion index of 1.159).

C. Supply and demand for production factors

i) The link between agricultural activity and demand for capital is estimated as comparatively low, both directly and indirectly (value added index and multiplier).

ii) The direct and indirect effects of farm activity on local wages and salaries (demand for labour) are comparatively low (cumulated primary input coefficient for employment of 0.055). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.049).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 1.729).

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively moderate (forward interconnectedness index of 4.733).

<u>Corse-du-Sud (FR) – Intermediate Open Space (refined OECD classification)</u>

A. Provision of non-agricultural goods and services to the farm sector

i) An increase in agricultural output generates low to average effects for other local sectors providing goods and services to local agriculture as well as for the whole local economy (low global effects; average indirect effects).

ii) The most important knock-on effects associated with local agriculture are found in the Real Estate sector (0.212).

iii) On the other hand, taking into account average sector sizes, agricultural effects are characterised as very high (backward dispersion index of 2.749).

iv) Outsourcing of local agriculture (number of backward transactions between agriculture and the other sectors) is also of an average extent (interconnectedness index is 5.357).

v) However, if the relative size of local agriculture is taken into account, effects of local farming on local output and income are quite low (elasticities of 0.010 and 0.015, respectively).

B. Use of farm output in the rest of the economy

i) Forward linkages of agriculture with the rest of the local economy (i.e. the increase in the output of sectors which use farm output as an input) are exceptionally high, both in global (2.749) and indirect (1.728) terms.

ii) Forward links between agriculture and the local Food Processing (0.516), Trade (0.142) and Hotels and Catering (0.160) sectors are also considerably high.

iii) In turn, Food Processing (Table 26) is characterized by very high backward and forward linkages with the rest of the local economy (with the exception of demand for capital and labour). The backward and forward links of Trade (Table 27) with the rest of the economy are also high, while Hotels and Catering (Table 28) also “exhibits” high linkages with the exception of those associated with demand for labour and capital.

iv) Compared to other sectors, forward links of local agriculture are ranked as average (forward dispersion index of 0.875).

C. Supply and demand for production factors

i) In contrast to the above pattern of effects, the link between agricultural activity and demand for capital is estimated as very low, both directly and indirectly (value added index and multiplier).

ii) Direct and indirect effects of farm activity on local wages and salaries (demand for labour) are very low (cumulated primary input coefficient for employment of 0.098). This holds even if the relative size of the sector is taken into account (employment elasticity of 0.009).

iii) On the other hand, a unitary increase in farm-labour supply (i.e. and in associated value of wages and salaries) generates significant knock-on effects for this local economy (multiplier of 2.557).

iv) Direct and indirect land consumption (hectares per one ml Euro of output) by local agriculture is (compared to that of other regions investigated in this report) average (Table 30). Direct consumption associated with farm output represents 99.98% of total consumption. Also, land consumption by Food Processing is high, and that by Public Administration and Hotels and Catering rather low.

D. Potential for diversification of farm activities

i) The extent of diversification of farm activities is considered as comparatively moderate (forward interconnectedness index of 3.694).

In general, the major findings of the regional interdependence analysis are as follows:

In terms of the provision of non-agricultural goods to the farm sector:

- All types of estimated linkages are found (as in most other relevant studies) to be generally low.
- Backward linkages are generally low.
- Backward dispersion indicators are low, showing that agriculture is not a key sector in terms of backward linkages.

- Output and income elasticities are generally low
- Finally, findings on the extent of outsourcing by agriculture seem rather mixed.

In terms of the use of farm output in the rest of the economy:

- All types of estimated linkages are generally satisfactory and in some cases, quite significant.
- Forward linkages are generally high and rank very highly in several study areas.
- Agriculture is a key sector in many areas in terms of forward linkages.
- In 13 out of 17 study areas, agriculture is characterized by its strong forward links with Food Processing and/or Trade and/or Hotels and Catering.
- In these particular areas there is a clear correlation between high forward links of Agriculture with Food Processing/Trade/Hotels and Catering and high backward and forward links of these three sectors with the rest of the economy. This is a clear indication of win-win situations.

In terms of supply and demand for production factors:

- In general, links between Agriculture and demand for capital and labour are rather low.
- On the other hand, taking the relative size of agriculture into account, employment elasticities are satisfactory in several areas.
- The economy-wide effects of agricultural labour supply seem to very high.
- Direct and indirect water consumption fluctuates considerably amongst areas and is very high in one study area. The same can be argued about land consumption.

Finally, farm activity diversification is generally quite satisfactory.

5.2 Comparative Analysis

The aim of this section is to comparatively present the findings of the interindustry links analysis. Comparative analysis is carried out in two levels, namely, a comparison of results between clusters and a comparison within clusters.

The comparative analysis of results between clusters, reveals the following:

<u>A. Provision of non-agricultural goods to the farm sector</u>

i) Linkages are very low especially in the case of Agriculturally-Dependent, Dynamic Areas (cluster 2).

ii) However, the situation is quite better in Diversified Dynamic Areas (cluster 3) and especially in Non-Dynamic Areas (cluster 1).

iii) Backward linkages are quite low, with the exception of being average in three Non-Dynamic Areas (cluster 1), one Agriculturally-Dependent, Dynamic Area (cluster 2) and three Diversified Dynamic Areas (cluster 3). This finding is further justified by the low estimated backward dispersion indices which show that agriculture is a key sector (in terms of backward linkages) only in Corse-du-Sud.

iv) The above-described pattern of results is repeated in the case of output and income elasticities (with the latter being a bit higher in general).

<u>B. Use of farm output in the rest of the economy</u>

i) The most satisfactory linkages are observed in Agriculturally-Dependent, Dynamic Areas (cluster 2) and secondarily, in Diversified Dynamic Areas (cluster 3).

ii) Compared to the other two clusters, forward linkages are marginally lower in Non-Dynamic Areas (cluster 1).

iii) Forward linkages rank very highly in several study areas in all three clusters, with agriculture often being a key sector.

iv) In general, satisfactory links between Agriculture and Trade are more frequently observed (especially in Non-Dynamic Areas and Agriculturally-Dependent Diversified Areas) than those between Agriculture and Food Processing and between Agriculture and Hotels and Catering. On the other hand, it is worth noting the high linkages between Agriculture and Food Processing in Diversified Dynamic Areas (cluster 3).

v) High forward linkages of Agriculture with Food Processing are observed in three Diversified Dynamic Areas (cluster 3), three Agriculturally-Dependent Dynamic Areas (cluster 2), while only one Non-Dynamic Area exhibits high links between the two sectors.

vi) In turn, Food Processing in the above areas (and especially in Diversified Dynamic Areas and Non-Dynamic areas) is characterized by high backward and forward links with the rest of the economy. On the other hand, demand for production factors by this sector seems rather low.

vii) High forward linkages between Agriculture and Trade are observed in four Diversified Dynamic Areas (cluster 3), four Non-Dynamic Areas (cluster 1) and three Agriculturally-Dependent Dynamic Areas (cluster 2).

viii) In turn, in all above areas, Trade exhibits very high (and rather uniform) backward and forward links with the rest of the economy.

ix) High forward linkages of Agriculture and Hotels and Catering are observed in three Diversified Dynamic Areas (cluster 3), two Agriculturally-Dependent Dynamic Areas (cluster 2) and two Non-Dynamic Areas (cluster 1).

x) Hotels and Catering seem to generally have high backward and forward links with the rest of the economy in all three clusters.

xi) In general, links between Trade and the rest of the economy are higher than those between Hotels and Catering and the rest of the economy and between Food Processing and the rest of the economy.

<u>C. Supply and demand for production factors</u>

i) Employment impacts (as portrayed by employment elasticities) are quite good in some Diversified Dynamic Areas (cluster 3).

ii) These links are comparatively higher in Diversified Dynamic Areas (cluster 3).

iii) The economy-wide effects of agricultural labour supply seem to very high in all three types of area, and especially in Diversified Dynamic Areas (cluster 3).

iv) Demand for both water and land has been found to be higher in Agriculturally-Dependent Dynamic Areas (cluster 3)

<u>D. Potential for diversification of farm activities</u>

i) The extent of farm activity diversification is satisfactory in Diversified Dynamic Areas (cluster 3). Diversification is lower in Agriculturally-Dependent Dynamic Areas (cluster 2) and especially in Non-Dynamic Areas (cluster 1).

The comparative analysis of results within clusters, reveals the following findings:

5.2.1 Cluster 1: Non-Dynamic Areas

i) Backward effects are very low in Rural Peripheral Areas (RPR), but seem to be improving in Rural Accessible Areas (RAR). In Intermediate Open Space Regions (IOR) backward effects improve further and reach an average size. These findings can be interpreted in terms of the rather narrow economic base of stagnant RPR due to locational disadvantages. In turn, RAR and IOR, despite being non-dynamic seem to have developed the economic base which can "serve" the input-needs of the farming sector.

ii) In terms of forward effects, linkages are comparatively lower in RPR. The size of linkages improves in IOR, while the highest figures are observed in RAR. An interpretation of these findings could centre on the highest supply-side linkages which seem to occur in the rather closed but not remote RAR. On the other hand, farm output in more open IOR and remote IOR seems to be leaking towards other regions and home consumption, respectively. The whole picture indicates that supply-side linkages are simultaneously affected by location and the adequacy of production to sustain downstream activities.

iii) With regards to the links between agriculture and production factors, these are found to be weaker in RPR. These links improve in IOR and are quite satisfactory in RAR. Here, farming in RPR and (in a less extent) IOR is less important (compared to RAR) in terms of employment, while lower sectoral interdependence leads to comparatively low capital and labour effects.

5.2.2 Cluster 2: Agriculturally-Dependent Dynamic Areas

i) Backward effects are considerably very low in RPR and IOR. However, their level is relatively satisfactory in RAR. These findings can be interpreted in terms of the fact that the economic base in agriculturally-dependent RAR is structured in a way that it can serve part of the input-needs of local farming. On the other hand, leakages are higher in both RPR and IOR, due to their lower and higher level, respectively, of integration with the rest of the world.

ii) If the estimates of the Alava region are generalized, then the highest forward effects are observed in IOR and secondarily, in RPR. On the other hand, forward effects are lower (but quite satisfactory) in RAR. An interpretation of these findings could centre on the higher supply-side linkages which seem to occur due to the development of a competitive agri-food complex in this agriculturally-dependent IOR. Remoteness and the development of tourism in the two agriculturally-dependent RPR seem to have promoted a rather "internalized" economic system, something that does not hold for the two more accessible RAR. In this sense, peripherality supports localized economies and offsets locational disadvantages.

iii) With regards to the links between agriculture and production factors, the picture is quite similar in the three categories of regions.

5.2.3 Cluster 3: Diversified Dynamic Areas

i) The highest backward effects are found in RAR, followed by those in RPR. Backward effects in IOR are considerably low. Here again the economic base in diversified RAR is structured in a way that it can serve the input-needs of local farming. On the other hand, leakages are higher in both RPR and IOR, due to their lower and higher level, respectively, of integration with the other areas.

ii) The highest forward effects are observed in IOR. These are marginally higher than forward effects in RPR. Forward effects in RAR are comparatively low. Again, the development of a competitive agri-food complex in these two IOR is associated with high supply-side linkages between farming and the rest of the economy. Remoteness and the development of tourism in the two RPR seem to have promoted a rather "internalized" economic system, indicating the operation of a localized cluster (farm-tourism) economy; on the other hand, leakages are higher in the two more accessible RAR.

iii) With regards to the links between agriculture and production factors, these are found to be higher in RAR, followed (quite closely) by RPR. These links seem to be quite low in IOR. Here, the importance of farming in the Latvian and Romanian areas plays a major role, something that does not hold for the two IOR.

6 Typology Proposal

Drawing on the findings of the last section and the aims of Step 1 as specified in the introductory chapter of this report, this section aims to propose a preliminary set of three typologies of rural regions. Taking into account the correspondence between the 17 case study regions and the different types of areas proposed here, EU-27 rural three regions could be classified accordingly. Further, according to the TWG2 workplan, the results of the case studies will be utilized for the further elaboration of this proposed typology.

In more detail, the following three types of typology are proposed (Tables 31 to 33):

a) Interdependence Typology: this typology combines observed patterns of backward and forward interdependence between agriculture and the rest of the economy. In total 12 types of areas are proposed.

The correspondence of the 17 study areas to the proposed types is as follows:

- 111: Ebersberg (DE)
- 112: Banska Bystricka (SK), Pesaro and Urbino (IT)
- 121: Waldviertel (AT)
- 122: Somogy (HU), Trikala (GR)
- 211: Vysocina (CZ)
- 212: Matera (IT), Rottal-Inn (DE)
- 221: -
- 222: Gers (FR), Alava (ES)
- 311: -
- 312: Caras Severin (RO), Gwynedd (UK), Corse-du-Sud (FR)
- 321 : Pieriga (LV)
- 322 : Kalmar Ian (SE), Overig-Zeeland (NL)

b) Supply-Side Typology: this typology combines observed patterns of forward interdependence between agriculture and the rest of the economy and reliance of agricultural sales on food processing or trade and hotels and catering (services). In total 12 types of areas are proposed.

The correspondence of the 17 study areas to the proposed types is as follows:

- 111: -
- 112: Waldviertel (AT), Ebersberg (DE)
- 121: Somogy (HU), Trikala (GR)
- 122: Banska Bystricka (SK), Pesaro and Urbino (IT)
- 211: -
- 212: Vysocina (CZ)
- 221: Gers (FR), Rottal-Inn (DE), Alava (ES)
- 222: Matera (IT)

- 311: -
- 312: Pieriga (LV)
- 321 : Kalmar Ian (SE), Overig-Zeeland (NL), Corse-du-Sud (FR)
- 322 : Caras Severin (RO), Gwynedd (UK)

c) Production Factors Typology: this typology combines observed patterns of interdependence between agriculture and production factors and forward linkages between agriculture and the rest of the economy. This combination has be chosen because frequently (at least in these study regions) relatively low reliance of farming with production factors is at the same time correlated with high forward linkages of farming with sectors which exhibit significant patterns of reliance on local production factors. In total 18 types of areas are proposed.

The correspondence of the 17 study areas to the proposed types is as follows:

- 111: Waldviertel (AT), Ebersberg (DE)
- 112: Somogy (HU)
- 121: -
- 122: Trikala (GR), Pesaro and Urbino (IT)
- 131: -
- 132: Banska Bystricka (SK)
- 211: -
- 212: Gers (FR), Rottal-Inn (DE), Alava (ES)
- 221: Vysocina (CZ)
- 222: Matera (IT)
- 231: -
- 232: -
- 311: -
- 312: Kalmar Ian (SE), Overig-Zeeland (NL), Corse-du-Sud (FR)
- 321 : -
- 322 : Gwynedd (UK)
- 331: Pieriga (LV)
- 332: Caras Severin (RO)

Table 31: Interdependence Typlogy							TYPOLOGY CODE
ECONOMY		BACKWARD LINKAGES		CODE	Forward Linkages	CODE FORWARD	
Non-Dynamic Areas	1	Moderate	1	11	moderate	1	**111**
	1		1	11	high	2	**112**
	1	Low	2	12	moderate	1	**121**
	1		2	12	high	2	**122**
Agriculturally-dependent Dynamic Areas	2	Moderate	1	21	moderate	1	**211**
	2		1	21	high	2	**212**
	2	Low	2	22	moderate	1	**221**
	2		2	22	high	2	**222**
Diversified Dynamic Areas	3	Moderate	1	31	moderate	1	**311**
	3		1	31	high	2	**312**
	3	Low	2	32	moderate	1	**321**
	3		2	32	high	2	**322**

Table 32: Supply-Side Typlogy							TYPOLOGY CODE
ECONOMY		FORWARD LINKAGES		CODE	Supply Dependence	CODE FORWARD	
Non-Dynamic Areas	1	Moderate	1	11	Food Processing	1	**111**
	1		1	11	Services (Trade and Hotels & Catering)	2	**112**
	1	High	2	12	Food Processing	1	**121**
	1		2	12	Services (Trade and Hotels & Catering)	2	**122**
Agriculturally-dependent Dynamic Areas	2	Moderate	1	21	Food Processing	1	**211**
	2		1	21	Services (Trade and Hotels & Catering)	2	**212**
	2	High	2	22	Food Processing	1	**221**
	2		2	22	Services (Trade and Hotels & Catering)	2	**222**
Diversified Dynamic Areas	3	Moderate	1	31	Food Processing	1	**311**
	3		1	31	Services (Trade and Hotels & Catering)	2	**312**
	3	High	2	32	Food Processing	1	**321**
	3		2	32	Services (Trade and Hotels & Catering)	2	**322**

Table 33: Production Factors Typology							TYPOLOGY CODE
ECONOMY		DEPENDENCE ON PRODUCTION FACTORS		CODE	Forward Linkages	CODE POTENTIAL	
Non-Dynamic Areas	1	Low	1	11	Moderate	1	**111**
	1		1	11	High	2	**112**
	1	Average	2	12	Moderate	1	**121**
	1		2	12	High	2	**122**
	1	High	3	13	Moderate	1	**131**
	1		3	13	High	2	**132**
Agriculturally-dependent Dynamic Areas	2	Low	1	21	Moderate	1	**211**
	2		1	21	High	2	**212**
	2	Average	2	22	Moderate	1	**221**
	2		2	22	High	2	**222**
	2	High	3	23	Moderate	1	**231**
	2		3	23	High	2	**232**
Diversified Dynamic Areas	3	Low	1	31	Moderate	1	**311**
	3		1	31	High	2	**312**
	3	Average	2	32	Moderate	1	**321**
	3		2	32	High	2	**322**
	3	High	3	33	Moderate	1	**331**
	3		3	33	High	2	**332**

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