PROJECT FINAL REPORT

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4.1 Final publishable summary report

4.1.1 Executive Summary

The aim of this project is to construct a complete and unique methodological framework custom built for the FADN database, that will support decision-making in the EU through a novel, easy to use, maintain and update interface, that will facilitate an efficient and operative monitoring of the impact of CAP reforms and market changes.

The project has successfully fulfilled its aims. More specifically, the construction of a harmonized literature review database on publications and research projects, methodologies of using FADN data, potentially applicable concepts and most promising modelling approaches resulted in the FADNTOOL Publications Library and is available at www.fadntool.eu. In addition, information on the terminated or ongoing research projects in which the FADN data were extensively used has been provided. Apart from presenting methodologies used in different projects, other information related to the organization of research teams, key problems and objectives as well as major finding are presented in a synthetic form.

The analysis of a model for individual decision making of a multi-product farm operating in a risky environment aimed to assess the effects of macroeconomic uncertainty, market volatility in the form of risk exposure, EU agricultural policies, and other market phenomena, on European agriculture at the industry and national levels. This has been achieved by linking the effects of such forces on individual farmers and farm households to industry-level measures of the farming sector. In the first stage, models of individual farmer behavior in the absence of uncertainty, which are aggregable to the industry level, are developed. In the second stage, both econometric and programming specifications of farmer behavior in the presence of risk and uncertainty are developed. An analysis for all EU27 member countries for the national and regional level and for all major crops was produced based on the results obtained from the econometric estimation of the theoretical models. In addition, a handbook on how the FADN can be utilized for economic simulation models is developed. A practical guide on how to extract the data using the coding system in FADN to calculate and assess information for the models is developed.

New models of Data Envelopment Analysis (DEA) suitable for the analysis of efficiency of agricultural farms in EU countries based on FADN data were also developed. This further included the development of new DEA models suitable for the analysis and calculation of elasticities of response of production and socio-economic factors with respect to policy changes. In addition, the extent to which agricultural subsidies are capitalised into land rental price was analyzed. The issue is analysed from both the firm level perspective and the territorial one.

Furthermore, whether farm income and Total Factor Productivity have a tendency to converge across countries, regions and sectors in EU agriculture was analyzed. The results suggest that all countries and regions have the same steady state for labour productivity. On the other hand, variability around the steady state due to random shocks increases over time. Then, a stochastic simulation model that has the capability to examine the impact of a range of pricing policies on farm-level profits is developed. This model has the capabilities of reflecting farm-level input demand and output supply responses and market uncertainty to different CAP policy scenarios. In addition, a GTAP global trade model was employed to obtain impact assessment results of tariff rates on welfare effects.

Finally, a custom product, which encompasses models for policy analysis exploiting both econometric techniques and mathematical programming is presented. This includes a detailed user manual - specifying the models' use cases, options and detailed operation - coupled with the provision of a common User Interface (UI), which obscures the more technical aspects of the models, allows the interested user to focus only on the preparation of an appropriate scenario of policy reform and on the inspection and interpretations of the ensuing results. The

innovative features of each of the models accessible via the common UI render the outcome of the FADNTOOL project a reference product for future policy analyses carried out both in Brussels and/or in every Member State.

4.1.2 Project context and objectives

The project's two main scientific objectives are (i) to construct a complete and unique methodological framework comprised of innovative and state-of-the-art economic models custom-built for the FADN database that allows for an overall analysis of the effects of agricultural policy changes and market developments on the agricultural sector and the whole economy, and (ii) to develop out of this framework a novel, easy to use, maintain and update interface for the use of the modelling tools by the EU and national FADN offices.
By addressing these issues, the project fulfilled the following specific objectives in a measurable, scientific way:

- Review of policy modelling literature that is based on FADN data (WP1)
- Development of a procedure to aggregate the supply response model to the regional, national and EU level (WP2)
- Development of a set of different, yet complimentary, models that capture and evaluate the different aspects of farmers' production decisions and their effects (WP3, WP5, WP6)
- Development of a stochastic simulation framework for model simulation and policy analysis (WP4)
- Assessment of the effects of policy reforms on farm structure (WP7, WP8)
- Development of a simplified, user-friendly interface for the use of the modelling tools and a complete handbook for all models developed in the project (WP9)

WP1: Review of Existing Approaches in the Use of FADN Data for Modelling

The aim of this work package is to review the literature in the use of FADN data for economic analyses and modelling and to establish a link with previous and on-going projects where the FADN data were extensively used. The work package produced a searchable, web-based literature review that consolidates all publications and research project outcomes that have used the FADN data. The web-based literature review is located at the project's web site, www.fadntool.eu. In addition, information on the terminated and on-going research projects in which FADN data were extensively used is presented. Projects are presented in the deliverable as case studies and include information from available sources and from direct contacts with project leaders.

WP2: Aggregation of the Supply Response Models to the Regional, National, and the EU Level

The aim of this work package is to assess the effects of macroeconomic uncertainty, market volatility in the form of risk exposure, EU agricultural policies, and other market phenomena, on European agriculture at the industry and national levels. This has been achieved by linking the effects of such forces on individual farmers and farm households to industry-level measures of the farming sector. The objective of this work package has been accomplished in two stages. In the first stage, models of individual farmer behaviour in the absence of uncertainty, which are aggregable to the industry level, are developed. In the second stage, both econometric and programming specifications of farmer behaviour in the presence of risk and uncertainty are developed.

WP3: Development of A Dual Econometric Model Analysing Farmers' Economic Behaviour

The objective of this work package is the development of a dual econometric model for analysing farmers' economic behaviour under recent and future changes in common agricultural policy by using FADN data. In the first stage of this work package, a handbook on the use of the FADN database in econometric models is developed and a dual economic model of supply response behaviour, which includes (i) a risk-neutral dual theoretical model, used as a benchmark for agricultural policy evaluation, and (ii) a dual theoretical model under uncertainty identifying possible effects of changes in common agricultural policy on farmers' production decisions under risk are developed, using the theoretical results provided by WP2, in order to ensure a consistent aggregation over farms and products at the regional or national level. The second stage of this work package includes the econometric estimation of both production models for each of the 27 EU member states and for their major products. This empirical evaluation will identify the effects of risk on farmers' behaviour and the potential differences or similarities across member states and agricultural products throughout the EU.

WP4: Development of Farm Optimization Models Analysing Farmers' Economic Behaviour and Structural Changes

The aim of this work package is to develop and estimate short to medium term, explicit optimisation models of farm supply behaviour, capable to assess the impact of different CAP farm payment schemes. Acknowledging that these separate farm models do not capture farm interaction on factor markets and structural adjustments, non-stationary Markov transition probabilities are estimated to update farm aggregation weights in ex-ante analysis. This also allows a direct link to more general policy simulation tools with market components developed in previous and current EU research projects.

More specifically, this work package has completed three separate tasks: i) Estimation of Farm Optimization Models for the EU 27 using FADN data, ii) Estimation of Markov Transition Probabilities for Farm Structural Change using FADN data, and iii) Integration of Farm Group Optimization Models and Structural Change Module within Ex-ante Simulation Framework.

WP5: Novel DEA Models for the Assessment of Efficiency of Farms and Elasticities of Socio-Economic Factor

The aim of this work package is the development of a unifying DEA approach, including new models and computation methods, for use with the data in the FADN database. There are three stages in addressing the overall objective of this work package. These three stages are:

- First, a thorough review was performed of the previous large-scale applications of DEA in the agricultural sector and the available data in the FADN database that impacted the further model development (e.g. model specification).
- Second, a range of new DEA models and methods was developed to assess the performance of farms and the impact of future policy decisions on the structural changes in the sector. The methodology for the assessment of structural change implemented in this WP was based on the calculation of appropriate elasticity measures, such as the production change of specific crops or livestock with respect to available resources.
- Third, the new models were validated and applied to all EU countries according to a variety of potential policy scenarios.

WP6: Development of a Dual Econometric Model Analysing the impact of EU Policies on Land Prices

The aim of this work package is to develop a set of econometric estimations carried out on individual farm data available in the FADN database, to directly evaluate the impact of Single Farm Payments on land prices.

WP7: Model Simulation and Policy Analysis

The main objectives of this work package are: i) to study the convergence or divergence of farm income and productivity between the member states using the FADN database, ii) to develop a simulation framework that acknowledges the different sources of uncertainty and investment rigidities impacting the estimates of input demand and supply response, and iii) to develop simulation of policy scenarios with respect to input demand, output supply, structural change and land prices.

More specifically, the following activities have been undertaken: i) Specification of multi-output multi-input distance functions, ii) Preparation of FADN data from different agricultural sectors so that they are suitable for econometric estimation, and iii) estimations of distance functions for different sectors. The findings suggest that in most cases the CAP, as the main controller of the EU's financial resources to the agricultural sector, failed to support changes in farm income such that the farm income level converges through regions and countries.

WP8: Development of the GTAPMH CGE Model and its Implementation for Impact Assessments on Farm Income

The aim of this work package is to assess the impact of EU CAP policies on farm income and income distribution in EU countries by means of simulations with a Computable General Equilibrium model called GTAPMH. The work in this work package simulates changes in the EU's farm policies by generating simultaneous responses in all EU farm sectors, the rest of the EU economy, and the global economy. This GTAPMH model incorporates multiple farm household groups using statistics from the FADN database. More specifically, it includes inter-sectoral, economy-wide, and international linkages. The policy simulations are linked to important effects obtained in work package 7.

WP9: Development of a User-Friendly Interface and a complete handbook for all models

The project aimed to develop a complete and consistent set of modelling tools based on FADN data that should ultimately aid policy-makers in assessing the impacts of policy and market developments on the agricultural sector (at the farm as well as at several different geographic levels). The realisation of this aim can be secured employing complementary, yet specialised, modelling approaches (i.e., econometric and mathematical) best suited to respond to the different research questions and extended to provide a significant advancement on existing techniques (i.e., allowing for the role of price uncertainty and risk, DEA models with trade-offs, modified GTAP model). Therefore, the models and techniques developed as part of the FADNTOOL project provide both a theoretical framework and an applied toolkit for advancing policy analysis in/of the agricultural sector. Selected empirical models have been packaged in a software tool allowing non-expert investigators to run different scenario-simulations, employing the most suitable model for the policy analysis of interest, using a common UI. An expert user (familiar with both the econometric/mathematical models and with some knowledge of the R and GAMS language) can further adapt and develop the models run by the UI or, in case she knew also some Java programming, could try to implement applications for the theoretical models developed as part of the FADNTOOL project. The UI is based on the Graphical GAMS User Interface Generator developed by

Wolfgang Britz (GGIG 2013) as a highly specialized GUI builder for GAMS based projects. It consists of four major components: (1) a GUI layer where control are defined from a XML file, (2) an application launcher which starts GAMS or R applications, (3) a data exploitation and mining tool which provides pre-defined views in sparse, multi-dimensional tools – thus, a post-model data layer, and (4) a set of utilities centred around GAMS projects and GGIG. The user-friendly, easy to maintain and well adapted to the FADN informatics environment UI can be used by the functionaries of the EU Commission and of the national FADN offices for their evaluation purposes. The UI allows the user to select the country of interest, the relevant years and variables as well as the expected changes in the exogenous variables/parameters due to policy reform. The UI compiles an include file which is passed along with the signal triggering the execution of the relevant code. In terms of results of the different models, the user interface will emphasise the key endogenous variables that are routinely used for policy analysis. The UI includes models for Data Envelopment Analysis (DEA), math programming models, stochastic simulation and land price estimation. In addition, results on structural change coming from the models developed in WP5 have been incorporated in the models, which can be run from the interface.
The same set of exogenous variables/parameters can be used to run different flavours of the same model and the ensuing results are presented in a way that makes them comparable.

4.1.3 Main S&T results/foregrounds

WP1: Review of Existing Approaches in the Use of FADN Data for Modelling

The key objectives of WP1 were a harmonized literature review and a study on modelling methodologies, results and experiences from selected terminated or on-going projects that were using the FADN data. In order to achieve these objectives the following activities were undertaken:
- Developing a conceptual framework for the web-based review of literature;
- Consulting the concept of the database with the partners through e-mail communication and presentations at the project workshops;
- Constructing the database and simultaneous literature search and collecting information about the FADN data based research projects (the list of the projects that were provided an access to the FADN data was received finally from the DG_AGRI).
- Receiving contributions from the partners on bibliographic data of publications to be considered in the literature review;
- An attempt was made to contact FADN offices in all EU countries from which the information on national FADN related research activities and publications was requested (unfortunately only Hungarian and Polish FADN responded);
- Introducing characteristics of the publication and information on the research projects to the database;
- Preparing deliverables and presentations at the project workshops.

The results of WP1 activities are two deliverables and the database "Harmonized Literature Review" accessible on the Internet through the FADNTOOL web page. Accordingly, deliverables have been amended at the end of the project. Before termination of the project there were also some changes to the construction of the database introduced, in order to improve its functionality. Prior to this, comments and suggestions of improvements were collected from a number of potential end-users.

WP2: Aggregation of the Supply Response Models to the Regional, National and the EU level

A model for individual decision making of a multi-product farm operating in a risky environment is developed. Farmer attitudes towards risk are assumed to belong to the

invariant preference class that contains mean-variance preferences. It is assumed in the model that the producer faces output-price risk i.e. output prices are assumed stochastic but neither input-price nor production risk i.e. input prices and the technology are considered as non-stochastic. It is shown that the invariant preference class permits a two-stage procedure to solving the individual farmer's decision problem. In the first stage, the farmer chooses the optimal output portfolio associated with each level of risk. In the second stage, the farmer chooses his optimal level of risk.

This two-stage decomposition procedure of the producer problem is accomplished by the dual development of an efficient frontier that relates the producer's efficient expected return to the level of risk that he faces. The optimal level of risk is chosen by equating the marginal rate of substitution between risk and expected return to the slope of the efficient frontier. Optimal output supply portfolios and input demand structures are derived from the efficient frontier by generalizations of Hotelling's Lemma and Shephard's Lemma.

Aggregation for risk-averse farmers with invariant preferences is based on two aggregation schemes: exact aggregation and aggregation with an aggregation parameter. It is shown that exact aggregation requires farm-level cost functions to be affined in outputs and quasi- fixed inputs and that the efficient frontiers for all farmers are linked to risk, must be vertical translations of the efficient frontier for a reference farmer, and all farmers must produce a multiple of an efficient output portfolio. For certain risk measures, the efficient output portfolio will result in specialization in a single crop having the highest variable profit per unit of price risk borne.

It is demonstrated that aggregation with an aggregation parameter that is independent of input prices is possible, and that individual farmers can possess different efficient frontiers that depend upon their endowment of quasi-fixed factors.

Based on the decision-making model and aggregation, procedures have been developed as aggregate supply-response, and input-demand equations with invariant preferences are derived. Based on the chosen exact aggregation procedure it is shown that the aggregated output is the sum of production and the aggregated input demand is the sum of the input demands for the representative farmers. Basic assumptions imposed in establishing the aggregated supply response system refer to costs structure that is assumed to be the same for all producers and to the output prices assumed to be the same random output prices for all farmers. Specification of the aggregated supply response system requires the specification of the individual attitudes towards risks and for this the quadratic form is used.

The following describes the model of invariant producer behaviour facing price risk that was developed in this work package.

1.1 Producer Preferences

Producer preferences over random profit, denoted $\pi \in R^{\Omega}$,[2] are of the invariant class

$$W(\pi)=\varphi\left(\mu[\pi], r[\pi]\right),$$

where $\mu[\pi]$ denotes the expectation of profit, $r[\pi]$ is a real-valued "risk" or dispersion measure and φ is strictly increasing in its first argument and strictly decreasing in its second argument.

The risk measure is sublinear (positively linearly homogeneous and convex) with $r[\pi] \geq 0$ for all π and $r[0]=0$. Moreover, $r[\pi]$ is translation invariant so that adding a nonstochastic constant to any random profit does not change the associated risk:

[2] R^{Ω} denotes the random variable space formed by mapping the underlying state space, Ω, to the reals. In a standard abuse of notation the random variable which assumes the same real number, x, in all states is written simply as x.

$$r[\pi + \alpha] = r[\pi]$$

for all α real.

1.2 The Decision Environment and Cost Structure

Individual producers face stochastic prices, denoted by $p \in R_{++}^{\Omega \times M}$, for their outputs, which are denoted $y \in R_{+}^{M}$. The quasi-fixed factor endowment for the producer is denoted *k*. Production is nonstochastic, but output prices realized by farmers are stochastic. Hence, if $M \neq 1$, p is interpreted as a vector of *M* random variables whose inner product with *y*, denoted $p'y$ is a nonnegative scalar random variable. Cost associated with producing the vector of outputs given nonstochastic prices for their *N* inputs, denoted by $w \in R_{++}^{N}$, is given by the variable-cost function $c(w,y,k)$ which is superlinear (positively linearly homogeneous and concave) and nondecreasing in *w*. The cost function is dual to the input requirement set:

$$V(y,k) = \cap_{w>0}\{x : c(w,y,k) \geq w'x\}$$

2 Invariant Preferences and Optimal Risk Exposure

The producer's problem is to choose his or her output portfolio to

$$\begin{aligned} &\max_y \{\phi(\mu[p]y - c(w,y,k), r[p'y - c(w,y,k)])\} \\ &= \max_y \{\phi(\mu[p]y - c(w,y,k), r[p'y])\} \\ &\vdots \end{aligned}$$

where $\mu[p] \in R_{+}^{M}$ now denotes the *M* dimensional vector of mean output prices, and we have used the translation invariance of r[] to obtain the equality.

Agricultural producers can be viewed as solving their optimization problem in two steps. In the first, for every level of risk exposure, r, they choose an optimal portfolio that maximizes the expected profit associated with that level of risk. This maximal expected profit for a given level of risk, r, is denoted M(p,w,r).

Theorem 1 *If c(w,y,k) is convex in y, M(p,w,r) is nondecreasing and concave in r.*

Maximal expected profit, which would be chosen by a risk-neutral individual, is at the risk level (if one exists) where *M* assumes a zero slope. The individual, however, chooses his optimal risk exposure by equating his marginal rate of substitution between return and risk to the slope of the efficient frontier. Thus, for smooth preferences the individual solves

$$M_r(p,w,r) = -\phi_2/\phi_1, \tag{1}$$

where ϕ_k denotes the kth partial derivative of ϕ.

3 The Efficient Frontier and Supply Response

We first state a basic result on the curvature and homogeneity properties of the efficient frontier, that can be demonstrated with a straightforward argument.

Theorem 2 $M(p,w,r)$ *is positively linearly homogeneous in (p,w,r) and convex in w.*

Provided that c(w,y,k) is convex in *y*, the producer's problem in determining the efficient frontier is a concave programming problem subject to convex constraints. In what follows, we

maintain the assumption that c(w,y,k) is convex in *y*. Hence, the first-order conditions for an optimum are necessary and sufficient to characterize optimal behavior. It can be shown that the first-order condition requires that

$$\mu\,[p]'y^{o}-c'\left(w,y^{o};y^{o}\right) \quad = \quad M_{r}(p,w,r)r \tag{2}$$

Expression (2) thus gives the rate at which the producer optimally trades off risk and return when confronted by the technology embedded in $c(w,y,k)$. In words, $\mu\,[p]'y^{o}-c'\left(w,y^{o};y^{o}\right)$ is the change in producer expected profit associated with a small radial expansion in the output bundle. Its nonnegativity reflects the fact that the producer can increase expected profit provided he or she increases his risk exposure marginally.

It can also be established that taking a directional derivative of M(p,w,r) with respect to each of the stochastic output prices yields the optimal supply of the respective output contingent upon a given level of risk exposure. This result generalizes the familiar result from the theory of the competitive firm facing nonstochastic prices, Hotelling's Lemma, that the derivative of its profit function with respect to the output price equals its profit maximizing supply.

Finally, applying the envelope theorem to M(p,w,r), while invoking Shephard's lemma, gives

$$M_{w}(p,w,r) \quad = \quad -x(p,w,r) \tag{2}$$

$x(p,w,r)$ is the optimal input demand associated with a risk level of r.

Hence, M(p,w,r) characterizes a dual supply-response system that is conditional upon the level of risk exposure chosen by the individual producer and that can be deduced directly from M(p,w,r). Once the former is determined from (1), then the associated optimal supply and derived demands are known.

4 Aggregate Supply-Response and the Representative Invariant Producer

Because of differences in ability and knowledge and endowments of factors of production that are not easily observable or tradable, one expects that at an empirical level different producers will face different technologies. In this section, we develop a model of a 'representative' producer that allows different producers to face different production structures, but that allow aggregation of those producers decisions into those of a single 'representative' producer.

Notationally, we now let $\left(y^{j},k^{j}\right)$ represent, respectively, the level of production and the quasi-fixed factor endowment of the j*th* producer and $c^{j}\left(w,y^{j},k^{j}\right)$ represent his or her cost structure, where we assume that there are *J* distinct producers. All producers are assumed to face the same input price structure and the same random output prices

The requirement for the existence of a representative producer employed here is the simple one that the representative producer's cost, denoted by $C\left(w,\sum_{j}y^{j},\sum_{j}k^{j}\right)$, equals the sum of individual costs:

$$C\left(w,\sum_{j}y^{j},\sum_{j}k^{j}\right)=\sum_{j}c^{j}\left(w,y^{j},k^{j}\right), \tag{7}$$

represents the class of farm-level cost structures that are consistent with the existence of a 'representative' producer.

We have the following consequence for farm-specific efficient frontiers:

Theorem *If there exists a representative producer, his or her efficient frontier can be written for r>0*

$$M(p,w,r) = m(p,w)r - C(w,0,0)$$

and the efficient frontier for each of the J producers can be written for r>0

$$M^j(p,w,r) = m(p,w)r - \gamma(w)k^j - \alpha^j(w)$$

where

$$m(p,w) := \max_y \{[\mu[p] - \beta(w)]y : r(p'y) = 1\}$$

From the Theorem, we draw four conclusions. First, the efficient frontier for the representative producer is affine in *r* with its intercept equal to minus its level of fixed cost. Second, the efficient frontiers for all producers are vertical translations of the efficient frontier for the representative producer. Third, each producer's variable expected profit is proportional to his risk exposure with the degree of proportionality given by *m(p,w)* which is common across producers. And fourth, as a consequence of this proportionality, all producers achieve their optimal risk exposure by purchasing some multiple of the optimal production portfolio defined by:

$$Y(p,w) = \arg\max\{[\mu[p] - \beta(w)]y : r[p'y] \le 1\}.$$

WP3: Development of a Dual Econometric Model Analysing Farmers' Economic Behaviour

The objective of WP3 is to develop a theoretically consistent econometric model for analysing farmers' economic behaviour under recent and future changes in common agricultural policy by using FADN data, which will be implemented in two stages. The first stage is about the development of a dual economic model of supply response behaviour, which includes (i) a risk-neutral dual theoretical model, used as a benchmark for agricultural policy evaluation, and (ii) a dual theoretical model under uncertainty identifying possible effects of changes in common agricultural policy on farmers' production decisions under risk. Both models have been developed using the theoretical results provided by WP2 ensuring a consistent aggregation over farms and products at the regional or national level.

The second stage of this WP includes the econometric estimation of both aforementioned production models for each of the 27 EU member states and for their major products. In that way it can be possible the identification of possible differences or similarities across regions or countries, which can give a more detailed analysis of the European agricultural sector; while the developed model would be applied in every EU country in the future under different scenario or dataset, which will make possible the development of more specific policies across member states. In addition, this empirical evaluation can identify the effects of risk on farmers' behaviour throughout the EU.

As a first step a cost function model assessing the effects of policy changes on farmers' production under risk neutrality or uncertainty was developed. As the emphasis of

the project is how to use farm level data and information to analyse policy effects at the national and EU level, new results were developed to consistently aggregate across farmers and products. The risk neutral theoretical model was developed relying on the theoretical framework defined by WP2, so as a consistent aggregation was made possible across farms and products at a regional, national and EU level. Secondly, based on the risk-neutral model mentioned above, the WP worked on developing a model of farm production decisions under uncertainty based on invariant preference setting, which was again developed using the theoretical results produced by WP2 to aggregate among farms and crops.

Additionally, an empirical analysis of farm model at a sectoral, regional and national level using FADN database was developed. Firstly, the econometric model variables based on the handbook on the use of FADN Database for econometric models was developed using EXCEL, and secondly the econometrically the theoretical models developed was estimated using TSP software. The econometric estimation performed for all member states of EU (at national and regional level) and for all major products. The examination of farm model includes a detailed analysis of technological structure (supply and variable input demand elasticities, scale economies, rate of technical change and substitution possibilities) at the farm, regional and national level; this analysis also contains alternative estimates assuming risk aversion and risk neutrality. Finally, a user friendly, easy to maintain and well adapted to the FADN informatics environment prototype were produced readily applied in every EU country under different scenario or dataset.

On policy grounds, the estimation of the dual econometric model and the resulting elasticity estimations, will assist policy makers to evaluate the impact of policies at the national level based on information at the farm level after the appropriate aggregation and it is expected to pinpoint differences across Member states. The extended empirical application in D3.3, which covers the whole spectrum of farmers' behavior by having been applied to all EU states, enables the identification of differences among farmers, products and regions, a crucial parameter for deriving well-targeted and effective policy measures. Additionally, the development of both farm models mentioned above (under risk neutrality and under uncertainty) facilitates an efficient and operative monitoring of the impact of CAP reforms and market changes.

WP4: Development of Farm Optimization Models Analysing Farmers' Economic Behaviour and Structural Changes

The WP delivered the handbook on the use of FADN data in programming models. It is meant to provide a guideline on how the FADN can be used to parameterize mathematical programming models. This handbook was delivered before final decisions on model specification, therefore it offers a detailed as possible general source of information. In order to achieve the objectives of the deliverable and offer practical benefits for the econometric and mathematical programming activities, an FADN data mining tool was built allowing to implement flexible data extraction rules at farm and regional aggregation level. The following observations were made and actions taken:

- Land use activities
  - A strong increase in fodder activities in the EU-15 due to real developments and redefinitions of statistical categories (strong increase in maize production, switch from booking under pasture to fodder on other arable land).

  - Quantities and yields for fodder maize and pasture are not consistent. The quality of the information, however, seems to improve over the last years. To improve the yield information for modelling activities, animal requirements or other statistics need to complement FADN.
- Animal activities
  - 16 animal production activities were defined, then aggregated to four groups. The monetary returns come from (1) the livestock sales and is defined at group level, (2) from selling products like milk and eggs directly linked to the single animal production activities, (3) changes of livestock values recorded at group level again. The information in FADN does not allow all information to be linked directly to the animal activities, therefore, indicators such as animal shares can be used for allocation.
  - No information for fodder use per activity can be found in FADN. The only information is in monetary cost terms.
  - The pig and poultry statistic in FADN underestimates the reality, which probably results from the exclusion of commercial farms in the FADN sample.
- Inputs costs
  - Activity-specific input costs cannot be observed and have to be estimated based on the total cost position by farm.
  - The accounting position rent paid for land (F86) is not available before 2009. Total rent paid at farm can be used in order to approximate land rents.
- Subsidies and income
  - No values are found for subsidies paid for Article 68 in the current FADN database.
  - Inconsistencies exist between official documents describing the calculation of subsidies and the description of the accounting position.
- Constant Sample
  - Due to its importance for estimation purposes, the data mining tool reports a summary statistics on the number of farms which remain in the sample over time, aggregated at EU-27 and reported for each year until 2008 to the end year.
  - From 57,615 farms in 1990 only 1,419 are recorded over the complete time series until 2008. Although limited constant samples follow naturally from the sampling scheme, changes in farm keys lead to initial underestimation of constant sample sizes. DG-AGRI (FADN-Unit) provided a set of new farm keys for a better representation of the constant sample.
- Data Mining Tool
  - The tool's extraction rules were programmed in the General Algebraic Modelling Software (GAMS). Parallel processing was applied and a run for all farms, countries and years takes less than 1.5 hours.
  - The exploitation tool was set up with predefined views and tables. The viewer is part of the GAMS Graphical Interface Generator.

As seen from the literature review, PMP applications moved away from the early rather arbitrary specification and resulting simulation behaviour and instead use prior information in model calibrations. Applications of what the literature termed Econometric Mathematical Programming (EMP), i.e. the estimation of programming model parameters based on multiple observations, are still few –regarding number of papers and independent groups engaged in it.

Researchers still face considerable computational challenges for large-scale applications preventing, for example, to relax the assumption that constraints are binding for all observations. Moreover, full statistical inference on estimated parameters is not beyond the conceptual state yet.

A research gap we consider at least as important relates to the lack of a clear rationale, i.e. a combination of behavioural and technological assumptions for the use of typical PMP from model parameterizations. The only exemption is given by papers relying on a mean-variance risk analysis where the quadratic part of the objective function is rationalized by the covariance matrix of uncertain returns. A previously discussed and recently employed alternative of non-linear capacity constraints is shown to be completely equivalent to the non-linear objective function entries as long as certain functional restrictions are satisfied. Other behavioural or technological assumptions which would completely move away from typical PMP formulation but still allow for a differentiated analysis of factors affecting agri-environmental analysis interactions could not be identified. Progress in this area is needed to increase not only scientific acceptability, but also the trust in and understanding of this modeling approach in the policy process. This seems rather important given the increasing relevance of national and global issues requiring sound economic models with technology rich specifications of farm and aggregate agricultural systems.

Concluding from the literature review, we decided for the robust EU-wide model to start from the general structure of programming models in CAPRI (Britz and Witzke 2008) and the basic Bayesian estimation approach of Jansson and Heckelei 2011. Each farm is represented by a nonlinear programming model that captures all relevant activities and optimizes, a mean-variance utility function base on activity gross margins under restrictions relating to land and if applicable, to quotas and set-aside obligations. Premiums paid under the CAP are captured in detail. A major effort in the second part of the project lead to the successful development of the estimation approach to parameterize those farm models using the FADN sample. In particular, a two-step approach where first the covariance matrices of gross margins and input coefficients and subsequently the parameters of the PMP-type quadratic cost function together with the risk aversion coefficients were estimated. The general functionality of the approach was demonstrated with illustrative applications for Germany and the estimation exercise for the full EU. Estimation and simulation routines were successfully implemented in the joint project tool. A scientific paper on the approach has been accepted for presentation at the Congress of the European Association of Agricultural Economics in August and will also be submitted to an international journal of the discipline.

Further explorative programming models were investigated including the implementation and testing of an approach allocating inputs to production activities, simultaneously taking first order conditions of the farm optimisation model into account. Furthermore, the recently introduced idea of specifying PMP type models with a quadratic constraint in activity levels instead of a quadratic objective function was investigated. It could be shown to be equivalent in calibration but deviating in simulation from standard PMP formulations. Investigating extensions of this approach to introduce capacity constraints depending on farm labour and capital resources did not lead to a satisfactory combination of computational feasibility and level of theoretical consistency. Instead, estimations of model specifications with crop specific production functions and theory-consistent joint cost functions were investigated and further promising research is ongoing. Three scientific papers are prepared regarding these explorative approaches and will be submitted to journals in the comings months.

Regarding the task of predicting farm structural change and more specifically, the weights of certain farm types for policy simulations, a first result was to choose an MCI approach instead of the originally envisaged Markov chain analysis. This choice was due to research results after the proposal and before the project start but also to further tests comparing the two approaches at the beginning of the project. The MCI approach restricts the analysis to what is required for the project purpose, namely the prediction of shares of farm specialisations, and is more suitable for the use of FADN data which provides often very limited information on individual farm transitions as required for a use in the Markov analysis. Markov model and MCI model were both capable of detecting artificially generated patterns of farm structural change in a test. The MCI model performed as well as the non-stationary Markov model and even better than the Markov model with increased noise in the process.

With respect to the application of the MCI approach to the FADN data to Germany, the following conclusions are derived: (1) It is important to consider lagged farm type shares in specification where the lag structure might depend on the country, but for the German sample, four years was appropriate; (2) The model fit was already very high when only farm shares were included as explanatory variables. However, prices and other information may further increase the accuracy of the model; (3) Elasticities and simulation are very helpful to understand the final model specification. Our analysis focused primarily on the reactions of farm types with a relatively large share among all farm types. Generally, the reactions of the farm type shares to price changes can differ between size classes;(4) The within-sample comparison of the observed and predicted farm type shares reveals that the estimated farm type shares show almost the same pattern as those of the observed farm type shares. The absolute percentage differences between the observed and predicted shares are very low and are relevant only for specialist dairy farms in 1999 and for mixed crop-livestock farms in 2002.

WP5: Novel DEA Models for the Assessment of Efficiency of Farms and Elasticities of Socio-Economic Factor

This work package developed a unifying DEA approach for the use with the data in the FADN database, in order to assist the EU policy makers in the assessment of potential impact of their decisions on the EU agricultural sector at different levels. The results of WP5 show that all of its objectives have been achieved.

1 New models

The DEA methodology considers all the variables used in the analysis as either inputs or outputs. The inputs represent the resources of the production process. The outputs are the levels of production or socio-economic factors that are affected by the inputs.

In this project we use 4 inputs: land, capital, costs and labor. We also use 12 outputs: the production volumes of wheat, rye, barley, oats, grain maize, rice, dry pulses, potatoes, sugar beet, other crops, livestock and family net income.

Most of the data for the DEA models are straightforward FADN variables that show the production of different crops and livestock, and also the land use, capital, costs and labor. The only two exceptions are the other crops and family net income. The formula for other crops is given in Table 1 of Deliverable D5.2. The FADN data for family net income includes negative values. For the purpose of DEA, negative values are changed to 0.

No external variables from other databases are used. However, there is a number of subjective choices that the user needs to make. In particular, through the interface the user may choose the constant or variable returns-to-scale (CRS and VRS) basic DEA model and specify either the default trade-offs or new one that better reflect the production assumptions. For the calculation of elasticity, the user also needs to specify the sets of variables between which the calculation is to be evaluated.

The mathematical formulation of the new DEA models is lengthy and is given in detail in deliverable D5.1.

2 Programming implementation

The new DEA models are used for the calculation of efficiency of farms and elasticities of response that correspond to different policy scenarios. These models need to be solved for each farm in the selected region, which necessitates the organisation of several iterative processes.

The above procedure was implemented in the software developed in WP5 and coded in GAMs. The details of this implementation and program codes are included and discussed in detail in deliverable D5.2.

3 Computation

Extensive computations were performed for FADN regions from all EU countries, and under different policy scenarios. For example, we considered the effect of increasing all the resources available to farms in the long and short-run scenarios, and the impact of such policies on the production output of farms. The policy implications of such scenarios are different for different region and are presented in deliverable D5.3.

WP6: Development of a Dual Econometric Model Analysing the Impact of EU Policies on Land Prices

In the last two decades, many developed countries have changed their approach in designing agricultural policies, typically shifting from price support to different forms of direct payments. One distinctive feature of these payments is that they are very often linked to land use, through various implementation mechanisms.

The reform process of the European Union (EU) Common Agricultural Policy (CAP) for arable crops (cereals, oilseeds and protein crops) provides a typical example of this move. In fact, after the 1992 and 1999 reforms of the CAP, guaranteed minimum prices for cereals have been drastically reduced, while farm support has been mainly provided through direct payments. For this “first generation” of direct payments the linkage to land was very clear: payments were crop specific and were awarded to farmers based on the number of hectares planted to each crop.

This policy framework has drastically changed in 2005, once the last reform of the CAP has come into effect. The new scheme has replaced the area payments with a Single Farm Payment (SFP) based on historical entitlements, while maintaining the guaranteed minimum price for cereals at the levels established by the 1999 reform. Although under the new policy farmers are relatively free to choose what to produce (fruits and vegetables exception was eliminated with the 2007 reform of the fruits and vegetables sector) or even not to produce at all, the linkage to land is still in place. In fact, for each farm the payment rights can be activated only with a correlative hectare of the so-called “eligible land”. Farmers need to respect all cross compliance conditions such as maintaining land in good agricultural and

environmental conditions. Moreover, a key provision of the new policy is that the SFP rights are tradable among farmers, with or without land. The relative scarcity of eligible land and SFP rights can be a determinant of adjustments in the price of land. A number of recent studies have investigated the nature of these type of increasingly more decoupled payments and their impact on production decisions, under different hypothesis on farm behaviour [see, e.g., Oude Lansink and Peerlings (1996), Oude Lansink (1999), Moro and Sckokai (1999), Sckokai and Anton (2005), Serra et al. (2005), Sckokai and Moro (2006), Serra et al. (2006), Serra et al. (2009) and Sckokai and Moro (2009)].

Despite this move toward more decoupled policy tools, their linkage to land remains important, which raises a number of questions concerning the impact of these direct payments on land prices and farm income. These questions come mainly from the potential capitalization of direct payments in higher land values and the distribution of gains through land rents. This phenomenon may generate an increase in land value and rental prices, and, since the share of rented land is quite large in many EU countries, the impact on farm income deserves attention. To what extent had the "first generation" area payments a larger impact on farm income than previous support to prices? To what extent the new SFP scheme has larger or smaller impact on farm income than previous area payments?

The aim of this work package is to investigate the above issues through a set of econometric estimations carried out on individual farm data available in the EU-FADN database. In the time span of the project, new FADN data will be available, covering some years after 2005, which will allow us to directly evaluate the impact of the SFP on land prices. Unfortunately, land prices in the FADN database are mainly imputed, through the evaluation of land values made each year at the time of data collection. However, the reliability of these land prices will be crosschecked comparing them with prices coming from other sources.

By using data at the farm level for eight European countries (Italy, France, Germany, Greece, The Netherlands, United Kingdom, Poland and Bulgaria) the empirical analysis proposed in the first part of the study innovates with respect to existing studies in different ways. Thanks to the long time span available in the FADN database it is possible to compare the two time periods, before and after the 2005 CAP reform, to test whether any change occurred as a result of the introduction of the decoupled payments scheme. In contrast to previous empirical literature, which has either focused on the unobserved farm-level heterogeneity issue or on the selectivity issue, the method proposed in this paper accounts for both simultaneously. Finally, the same method is extended to account for endogeneity of some covariates. Overall, the results in the paper confirm previous evidence, suggesting only limited evidence that agricultural payments are capitalized into land prices. The evidence of capitalisation is by and large confirmed (in selected countries only) for the pre-decoupling period, while it is altogether absent in the post-decoupling period.

In the second part of the study, the issue of capitalisation is examined for the case of regions in the EU and the three year (2006-2008) time span following the introduction of the reform is considered in an attempt to disentangle the effect of the decoupling. Evidence put forward in the econometric analysis overturns the results of previous evidence at the micro-level, suggesting that an additional 1% granted to farmers translates into an increase of 0.22% in farmland rents. Based on these estimates four scenarios are simulated. The *EU flat rate, Min 80%*and *Min 90% and objective criteria* scenarios, part of the *Adjustment* driver of reform, and the *Integration* scenario discussed in European Community (2011) provide the expected percentage changes in direct payments associated with the next version of the CAP. Because the new CAP aims at equalising the level of per-hectare direct payments received across the EU-27, the majority of the countries of interest (mainly EU-12 countries) receive,

sometimes markedly, lower levels of direct payments across the different policy arrangements. The United Kingdom, Sweden, Finland and Spain are the EU-15 countries which benefit from some of the reforms scenarios experiencing a rise in the per hectare subsidies received while Portugal is the country, from the same EU area, which benefits from all the scenarios we consider. Perhaps unsurprisingly, given the aim of the new CAP, Estonia, Lithuania, Latvia – and to a lesser extent Poland and Slovakia – are the countries who benefit the most from these scenarios of policy reform. In particular, while Estonia experiences a doubling of the direct payments under the *EU flat rate* scenario, Latvia is expected to receive between two and more than two and a half times the per hectare direct payments it has been entitled to.

WP7: Model Simulation and Policy Analysis

The measurement of input demand and output supply responses at the sectoral level versus the regional level presents challenges that largely arise from the aggregation of decisions by farm units. These decisions are related to risk preferences, technologies, capital accumulation and the presence of idiosyncratic forces that are manifested as uncertainty. The development of supply responses at aggregated levels can be accomplished within a simulation framework that reflects the distribution of aggregate input demand and output supply responses. The stochastic/uncertain nature underlying the distribution can be related to the unobserved heterogeneity as well as environmental (weather) and market (price) shocks. How firms respond to these shocks makes it important for this work package to address range of potential responses. A key concern for the sectoral and policy related analyses are the capital accumulation patterns and how these impact supply response and input demand. Sluggish period of capital accumulation followed by investment periods can lead to more volatile output potential. From a micro-unit point of view, unit costs of additions to an individual firms capital stock may well be constant in the rate of investment or even decreasing if lump-sum adjustment costs are present. The main results of this work package are:

- Analysis of convergence of income and TFP using an up-to-date Bayesian estimation method. Analysis at country, regional and sectoral level. The first analysis of convergence performed across the EU and the first extensive analysis based on farm level data.
- Development of the first EU wide stochastic simulation model based on FADN data. The stochastic simulation model is innovative as it is based on econometrically estimated behavioural equations, which reflect the impact of prices of inputs and outputs, subsidies and fixed factors of production (land, labor and capital) on crop output, livestock output and variable inputs. Furthermore, the impact on profit can be analysed. The stochastic simulation model is also innovative by combining uncertainty about the production environment due to e.g. yield variation, with uncertainty in the market due to volatility of output and input prices. The model output goes beyond what existing policy simulation models provide, by generating not only the expected impacts of policy scenarios, but also the distribution of the impacts (e.g. confidence intervals).

WP8: Development of the GTAPMH CGE Model and its Implementation for Impact Assessments on Farm Income

This work package develops an impact assessment case study of a policy reform on farm income in EU15 countries using a version of the GTAP model, the $GTAP_{MH}$, which

disaggregates the single "household" variable of the GTAP model into several income groups. The policy reform under study is the scenario of the removal of tariffs for sugar imports in the EU15 countries.

FADN-supplied overall farm income is divided into five rural quintiles, supplanted by Eurostat-derived data on five urban quintiles so that, overall, the income groups span ten (10) rural poor to urban rich strata. FADN data provides the rural income distribution shares. Data from Eurostat provides the urban income distribution shares and the rural/urban population shares. The policy reform under study comprises a hypothetical removal of import tariffs for sugar in the EU15 countries. The impact of such a reform on the income strata of each one of the EU15 countries is presented in tables depicting quantitatively the income change, welfare change, primary factor-decomposed income change, as well as the percent change in volume of output, imports and exports, and the value of output, imports and exports in selected commodities.

The $GTAP_{MH}$ model and data are derived from the standard GTAP model and data by allocating income, factor ownership, and expenditures by commodity to multiple farm income groups using shares derived from the Farm Accountancy Data Network (FADN) database, for the farm income groups, and from Eurostat for the urban income groups: the total farm holdings population in FADN is being divided by 5, given that 20% of the farms population is to be found in each quintile; the income in each quintile is subsequently calculated by summing the farms' gross income of the farms belonging to that particular quintile. The share is calculated by dividing the total income in each rural quintile by the total (gross) income in the country.

The $GTAP_{MH}$ impact analysis provides (economic) welfare effects in the EU15 countries [decomposed in its Terms-of-Trade (ToT) effects and Allocative Efficiency effects] as well as quantitative impact assessment on the rural and urban income distribution per country (10 income groups in total). Percentage change in primary factor returns and percentage change in imports and exports of selected commodities are also obtained and presented. These quantitative results help provide a more thorough perspective of the changes on the farm income (concomitant to the policy reforms) in the EU countries.

Three main macro-economic effects of the simulated removal of EU15 tariffs on sugar imports are discussed, namely the economic welfare, GDP and primary factors returns. The welfare effects are small in terms of each country's GDP because even though EU15 sugar tariffs rates are high, sugar is a very small part of every economy. Sugar exporters, like those in Latin America, benefit from the removal of EU15 sugar tariffs and their gains are mostly due to improved terms of trade. Among the EU15, several countries experience welfare loses from the removal of sugar tariffs. Negative terms-of-trade effects contribute to the negative overall welfare effects. The allocative efficiency effects are negative for several of the EU15 countries. In the absence of any other taxes and subsidies these countries would have experienced gains in allocative efficiency from the removal of their sugar tariffs. However, because of other taxes and subsidies, the narrow import efficiency gains obtained from the removal of sugar tariff removals are offset by welfare loses elsewhere in the economy.

The simulated effects for returns to primary factors in the EU15 countries, differ significantly across countries. Overall, land is the endowment most affected by the reform. In Portugal and in Spain land rents actually increase because demand for certain Portuguese and Spanish farm products (grains and other crops) increases and prevents land rents from declining.

The simulated effects for imports of sugar by the EU15 economies show that all economies increase their imports of sugar. The percentage effects are different from economy to economy depending on the magnitude of the applied tariff rate removed. The impact assessment of the policy reform under study (simulation) depicts different effects (impact) for

the different income groups and the different countries. This is not surprising but expected; agricultural income distribution in EU is very wide and highly heterogeneous and there are big differences between regions and member states, farm types, and individual farms.

WP9: Development of a User-Friendly Interface and a complete Handbook for all models

WP9 has produced a common UI from which five main models can be executed and employed for policy analysis:

- DEA for all EU-27 countries and for the years for which data are available, in both/either the VRS and CRS flavour (with an option for calculating either/both elasticities and employing the related tradeoffs). The results can be viewed with either a tabular or graphical representation
- Structural change simulation where exogenous shocks in the price of aggregate outputs produce a change in the national agricultural sector
- Math programming models which, incorporating farmers' risk behaviour, allow for preparing policy scenarios affecting the price of outputs, the yields of activities, the change in the variance of output prices (i.e., the source of risk) and the premiums farmers obtain
- Land price estimation model which, imposing either an absolute value or a relative percentage change in the NUTS II per hectare payments, return the average, and 95% confidence interval, of the simulated cost of rented land in the NUTS II (simulation based on a estimates from a spatial model)
- Stochastic simulation model of input demand and output supply for all 27 countries and for the years for which data are available. Policy scenarios based on (single or multiple and simultaneous) shocks in the coupled and decoupled subsidies and/or price of one or multiple outputs and/or one or multiple inputs can be formed. Shocks are specified as percentage changes in the levels of these variables (with the same percentage change applied to a group of selected outputs) as well as can be augmented with the specification of changes in the volatility of either/both output 1 or/and 2 or/and of input(s)

Provided the user has installed the appropriate Java runtime engine and a copy of GAMS with the solver which are necessary to run the models, after having selected the model of interest and having specified the relevant scenarios, the user can run the model and explore the associated results all within the same common UI.

4.1.4. Potential impact and the main dissemination activities and exploitation of results

The FADNTOOL project has included numerous dissemination activities to the scientific community, to policy makers, to stakeholders, at the regional, national, European and international level. All deliverables, with the approval of the scientific officer, have been made publicly available through the project website to facilitate dissemination of results. Furthermore, each deliverable is accompanied by an extended summary and policy related results that make exposition of the empirical results easier to apprehend for the widest possible audience. Extensive interaction and feedback from stakeholders have greatly improved the work throughout the project and the quality of the deliverables. In addition, a leaflet was developed presenting the main findings and policy recommendations of the FADNTOOL project, translated in all partners' languages, distributed to a large audience. These findings, including the user interface, were presented in a demonstration seminar held in Brussels, Belgium and attended by EU and national FADN officers. Finally, the FADNTOOL project methodologies and results were disseminated through a number of

seminars, conferences, meetings, scientific journals, and through the organization of professional practical trainings, scientific practical trainings and a short course. A European EAAE seminar has been organized having as a particular theme the development of integrated and reliable modelling tools for agricultural and environmental policy analysis, where a broader audience of scientists working on policy analysis based on large datasets attended. In what follows, the main dissemination activities and exploitation of results by WP are presented.

WP1-2

First, one journal manuscript was prepared based on the results of WP2. It has been submitted to the International Economic Review for potential publication. The manuscript describes the use of this new model and contains an econometric application (see WP3). This study served as the template for a series of studies that were done in each of the FADN countries on modelling supply response under price risk. Second, models of producer behaviour under price risk that were based on the theoretical developments of this work package were estimated. Third, the team working on WP32 has actively engaged with the broader academic community via a number of international conferences in the field of productivity and efficiency analysis. The feedback obtained on the presentations of our results has helped us to shape directions of our research efforts.

The presentation of our research at EUROP mini-conference (Collaborative Decision Systems in Economics and in Complex Societal and Environmental Applications, Graz, Austria, 17-19 October 2013) won the prize for the best paper. The title of our paper was "DEA models for the analysis of efficiency of agricultural farms".

WP3-5

The potential impact of the research performed in WP4 relates to the scientific community and policy makers. The research on further developments in PMP-type programming models, namely the estimation of model parameters and the application of such approaches at farm level as well as the research on conceptual rationalisation is expected to contribute to the international research in this area. This has already started as can be seen from the already implemented publication and dissemination activities in the next section. Three draft versions of further scientific papers resulting from the research are available and will be finalised and submitted during the coming months. Overall, they are expected to push a sounder empirical basis for farm programming models and improve the acceptability of explicit optimisation models for agricultural policy analysis in the relevant scientific community.

We also expect a direct impact of research results in this work package on the ongoing dialogue between policy makers and economic modellers. Technical solutions chosen are easily integrated with the modelling platform currently run at the JRC/IPTS in Seville which support agricultural and trade policy processes in the EU. The FADN data mining tool can readily be used for a multitude of purposes which build upon EU farm level information. The structural change approach is highly welcome for addressing this issue endogenously in policy simulation exercises and thereby improving upon previous possibilities of the platform. Finally, the risk specification of the farm programming model might be of high interest to the farm model currently developed by JRC/IPTS. The latter is hopefully soon available to complement the market models for policies.

The purpose of WP5 was to create, validate and implement a new nonparametric methodology suitable for the analysis of efficiency of EU farming at the farm level and other levels of aggregation. The completion of this task has potential impact to both policy makers and the wider academic community.

From the policy maker's point of view, the new methodology provides a tool that is more effective in the analysis of efficiency and different scenarios than traditional nonparametric DEA methods. This is achieved by the use of additional information about production trade-offs between different farm outputs such as crops and livestock (either in the suggested default form or according to user-specified values). The use of such information results in significant improvement of the differentiation between the farms according to their efficiency status. In simple words, the new models are more sensitive than the traditional ones and provide better differentiation on efficiency not possible with the existing approaches.

From the broader academic perspective, the work of WP5 shows that the use of production trade-offs may be beneficial in a number of various applications, in agriculture and other sectors.

A significant part of the work on WP5 was devoted to the dissemination of results. Arising from the work on WP5, two academic papers have been prepared for peer-review journals, and the results were reported at a number of international academic conferences.

WP6

The issue of capitalization of agricultural payments into farmland prices is a widely discussed topic both in the academia and in policy-making environments. Empirical models proposed in literature provide an important tool to analyse to what extent an increase in agricultural payments translates into higher rents for the farmers, implying that part of the subsidy originally intended to support agricultural income is transferred out of the agricultural sector. Notwithstanding the large interest shown by the academic literature on the topic, most of the results of previous research diverge when it turns to the policy implications. While some studies have found evidence of capitalization, some others did only to a lower extent and, finally, evidence of capitalization is altogether absent in some other case. Such heterogeneity in empirical evidences is closely related to the type of data used in the analysis and to the empirical approach employed as well.

The FADN represents the most complete source of information on agricultural productions and costs of farmers in the EU and hence it is the natural candidate database for an analysis of capitalization concerned with all European countries. In this respect, the research, which has been conducted under this WP, is relevant for three main aspects. Firstly, it provides a detailed descriptive analysis of farmland related information available in the FADN alongside a discussion of how this information can be used in empirical works aimed at assessing the capitalization of agricultural payments in Europe. Secondly, it provides a unified framework for the micro-level empirical analysis of farmland rental prices based on FADN data source. Thirdly, it provides a theoretical and empirical framework to analyse the topic from a territorial perspective.

The main result of this work, to which the potential impact relates, can be summarized in few points:

1. There is weak empirical evidence of capitalization of agricultural subsidies into farmland rents at the micro level;
2. The evidence is similar for both the periods before and after the introduction of decoupled payments;

3. There is evidence of capitalization of decoupled payments when the analysis is conducted at the territorial level.

Overall these results exhibit relevant for the policy discussion and have a potential impact as well. Many empirical investigations of the capitalization effect focus on the farm. Nonetheless, it is more likely that the capitalization is less related to the farm-specific decision of the amount of land to rent and on the rent to be paid as well. Rental price at the farm level is more related to the intrinsic characteristics of the land. On the contrary it is likely that rental prices vary, as a consequence of increased agricultural support, across farms in different regions. This suggests that most of the policy discussion on the redistribution of agricultural support across states in the EU and across regions in member states, should consider the perspective of the territory more than that of the farm, when considering the issue of capitalization.

Hence the research conducted under this WP has considerable impact on both the academic and policy discussion. In terms of the academic debate, the evidence suggest that farm-level data in FADN can be used to address the capitalization issue to a limited extent only, because much of the information actually influencing farm rents (quality of land, characteristics of the rented land, type of production the rented land is used for) are not recorded in FADN. On the contrary FADN data can be best used to aggregate at the territorial level and to analyze the issue from such a perspective. In this respect, the research here conducted represents a first attempt to go in that direction and hopefully this will stream of research will be further considered in future empirical works. In terms of the policy debate the research results presented lead to seriously take into consideration the possibility that payments are capitalized. In all simulation scenario we have tested in our research it is found that a substantial increase in farmland rents characterizes new member states, where the level of agricultural support is assumed to increase as a consequence of the redistribution of payments. The evidence also highlights the possibility that land price exhibit a reduction in old member states, where agricultural support is assumed to diminish, but the estimated amount of such a reduction is substantially lower if compared to the farmland price increase in new member states.

Considering the policy relevance of the issues discussed in this WP and also the impact of the results of the research, a number of dissemination activities have been carried out during the research period aimed at discussing the theoretical, empirical and policy issues relate to this research.

The first part of the research was conducted surveying existing empirical approaches to estimate the capitalization effect and hence the nature of the work conducted has been primarily methodological. A discussion of the methodological aspects as well as of the results and related policy implications with scholars carrying out similar research has been possible by participating at the following conferences:

a. Congress of the European Regional Science Association, held in Bratislava, August 2012;
b. Congress of the Italian Association of Agricultural and Applied Economics, held in Parma, June 2013;
c. 133 seminar of the European Association of Agricultural Economists, held in Chania, June 2013;
d. Symposium of the International Agricultural and Trade Consortium, held in Sevilla, June 2013;
e. Conference of the American Association of Agricultural Economists, held in Washington, August 2013.

The primary outcome of this research is a number of papers, which have been currently published in part as conference papers and are currently being prepared for the submission to

international journals. Furthermore, the methodological aspects of this research have been presented as part of the course for PhD students on the use of FADN data for the analysis of agricultural policies, held in Wageningen, December 2013.

WP7-8

The analysis of convergence of labour income and Total Factor Productivity (TFP across the EU has a number of policy implications. The results suggest that farm income tends to converge to the same value across the EU in the long run. The result is found for the EU-15 and for the EU-25. This finding implies that all countries and regions have the same long run steady state for labor productivity. The finding supports the view that EU agricultural policy enhances agricultural income equality across the EU. On the other hand, the results also indicate that variability around the long-run steady state increases over time. Hence, temporary deviations from the long-run steady state become bigger.

When looking at convergence in TFP the data suggest convergence at the regional level, but not at the country level, when considering either EU-15 or EU-25. This finding suggests that policies promoting structural changes at the regional level tend to speed up technological catch-up of the worst performing regions, but this effect does not translate into catch-up at the more aggregate country level. Hence, individual badly performing regions are benefitting from the EU policy in terms of TFP. However, badly performing countries do not increase TFP more rapidly. Hence, EU policy does not succeed in enhancing TFP convergence EU wide.

The stochastic simulation model will be used by future users in DG-AGRI. The exploitation of the stochastic simulation model is supported by providing a detailed description of the code and a users guide. The outcomes of the stochastic simulation model provide relevant information for policy makers, not only about the expected impact of a policy change, but also about the distribution of impacts. Hence, policy makers get information about the level of uncertainty of outcome of policy scenarios.

WP9

The UI developed for the FADNTOOL project provides a unique example of a common UI employed to run models of different nature, as opposed to existing implementations, which have concentrated mainly on one type of model at a time (i.e., CAPRI). Relying on one common UI has posed several challenges with respect to software development as different programming languages have been employed and were required to operate in synergy and towards a common goal. Nonetheless, employing this common UI, the Commission will have the opportunity to carry out selected policy analyses within a framework, which, obscuring the more technical layers of modelling, allows for concentrating on conceiving a proper policy scenario. Moreover, the outputs of the simulation scenarios are provided in a user-friendly format allowing further manipulations, especially for presentation purposes. Therefore, the UI interface for the models developed in FADNTOOL could be providing the quantitative evidence for the policy scenario analyses of DG-AGRI and for informing the policy discourse both at the European and the National level. To this end, a presentation to the EU Commission delegates, the national and EU FADN officials has been delivered to instruct potential users about the ways to operate the UI including model selection, parameter specification, launch of the model and exploiting of the results. The final layout of the UI has been constructed striking a balance between each model's capability and possible application given the demands of the EU FADN and Commission officials expressed at the four interim meetings of the project.

Project Logo

Integrating Econometric and Mathematical Programming Models into an Amendable Policy and Market Analysis Tool using FADN Database

Project Public Website
The website address is http://www.fadntool.eu

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4.2 Use and dissemination of foreground

Section A (public)

This section includes two templates

- Template A1: List of all scientific (peer reviewed) publications relating to the foreground of the project.
- Template A2: List of all dissemination activities (publications, conferences, workshops, web sites/applications, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters).

These tables are cumulative, which means that they should always show all publications and activities from the beginning until after the end of the project. Updates are possible at any time.

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES										
NO.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers[3] (if available)	Is/Will open access[4] provided to this publication?

1	Supply Response Behavior under Invariant Preferences.	*Chambers, R.*	*Submitted*							no
2	Assessing the efficiency of units with multiple outputs: an application to agriculture	*Chambers, R.*	*Under review process*							
3	On the calculation of elasticity measures in different technologies	*Chambers, R.*	*Under preparation*							
4	Convergence in Agricultural Productivity in the EU	Emvalomatis, Grigorios	*(submitted)*							
5	An econometric model of EU crop and livestock farming	Roa, Monica	*(to be submitted)*							
6	A stochastic simulation model of EU crop and livestock farming	Roa, Monica	*(to be submitted)*							
7	*Positive Mathematical Programming Approaches – Recent Developments in Literature and Applied Modelling*	*Thomas Heckelei*	*Bio-based and Applied Economics*	*Issue 1*	*Firenze University Press*	*Florence*	*2012*	*pp. 109-124*	*Doi: 10.13128/BAE-10567*	
8	*Integrated software tool for processing accountancy data information at EU level - an application of CGIG*	*Sebastian Neuenfeldt*	*Massendatenmanagement in der Agrar- und Ernährungswirtschaft – Erhebung-Verarbeitung-Nutzung: Referate der 33. GIL-Jahrestagung*	*20-21 February*	*Kölln Durck+ Verlag GmbH*	*Bonn*	*2013*	*pp. 239-242*		

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[5]	Main leader	Title	Date/Period	Place	Type of audience[6]	Size of audience	Countries addressed
1	Conference		*International Agricultural Trade Research Consortium*	11-15 June	Sevilla (Spain)	Scientific community, Industry	100	Global
2	Conference		*133rd Seminar of the EAAE*	15-16 June 2013	Chania, (Greece)	Scientific community, Industry	300	Global
3	Conference		*Productivity Workhop in Education Economics*	24-25 June 2013	Thessaloniki (Greece)	Scientific community, Industry	50	Global
4	Conference		*13th European Workshop on Efficiency and Productivity Analysis*	17-20 June 2013	Helsinki, (Finland)	Scientific community	300	Global
5	Conference		9th International Conference on DEA	24-28 August 2011	Thessaloniki, Greece	Scientific community	200	Global
6	Conference		Annual Conference of the OR Society	6-8 September 2011	Nottingham, UK	Scientific community, Industry	300	Global

[5] A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

[6] A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

7	Conference		Annual Conference of INFORMS	13-16 November 2011	Charlotte, USA	Scientific community, Industry	2000	Global
8	Conference		North American Productivity Workshop VII	7-9 June 2012	Houston, USA	Scientific community, Industry, Policy makers	300	Global
9	Conference		EURO	8-11 July 2012	Vilnius, Lithuania	Scientific community, Industry	2500	Global
10	Conference		Asia-Pacific Productivity Conference	25-27 July 2012	Bangkok, Thailand	Scientific community, Policy makers	500	Global
11	Conference		133rd Seminar of the EAAE	15-16 June 2013	Chania, Greece	Scientific community, Industry	300	Global
12	Conference		13th European Workshop on Efficiency and Productivity Analysis	17-20 June 2013	Helsinki, Finland	Scientific community	300	Global
13	Conference		11th International Conference on Data Envelopment Analysis	27-30 June 2013	Samsun, Turkey	Scientific community, Industry, Policy makers	160	Global
14	Conference		EURO	1-4 July 2013	Rome, Italy	Scientific community, Industry, Policy makers	2000	Global

15	Conference		EURO Mini-conference	17-19 October 2013	Graz, Austria	Scientific community	100	Global
16	Congress		European Regional Science Association	August 2012	Bratislava (SK)	Scientific Community	600	All Europe
17	Congress		Italian Association of Agricultural and Applied Economics	June 2013	Parma (IT)	Scientific Community	150	Italy
18	Seminar		European Association Of Agricultural Economics	June 2013	Chania (GR)	Scientific Community	150	All Europe
19	Symposium		International Agricultural and Trade Consortium	June 2013	Sevilla (ES)	Scientific Community	200	All Europe
20	Conference		American Association of Agricultural Economists	August 2013	Washington (US)	Scientific Community	800	North America and Europe
21	PhD School		Course on the use of FADNTOOL data for the analysis of agricultural policies	December 2013	Wageningen (NL)	PhD Students	20	All Europe
22	*Conference*	*WU*	*Convergence in Agricultural Productivity in the EU*	*4 June 2013*	*Seville*	*Scientific Community and policy makers*	100	EU
23	*Conference*	*WU*	*Convergence in Agricultural Productivity in the EU*	*15 June 2013*	*Chania*	*Scientific Community and policy makers*	100	EU
24	*Other (PhD course)*	*WU*	*Econometric and Mathematical Programming Models for Policy Analysis using FADN Data*	*9-13 December 2013*	*Wageningen*	*PhD students/ Scientific community*	*20*	*EU*
25	*Workshop*	*UCSC*	*Final presentation of results*	*19 May 2014*	*Brussels*	*Scientific community/ Policy*	*50*	*EU*

						makers		
26	*Demonstration and training activities on the common UI*	*UCSC*		*19 May 2014*	*Brussels*	*Policy makers and FADN officials*	*30-40*	*EU-25/EU-27*
27	*Conference*		*International Agricultural Trade Research Consortium*	*3 June 2013*	*Seville, Spain*			
28	*Conference*		133rd EAAE Seminar ,	*14-16 June 2013*	*Chania, Greece*			
29	*Conference - Massendatenmanagement in der Agrar- und Ernährungswirtschaft : Referate der 33. GIL-Jahrestagung*	*Sebastian Neuenfeldt*	*Integriertes Softwaretool für die Verarbeitung von Buchhaltungsdaten - Eine Anwendung von GGIG*	*20-21 February 2013*	*Potsdam*	*Scientific Community*	*30*	*Germany*
30	*Presentation*	*Sebastian Neuenfeldt*	*Exploring and forecasting structural change using Market share and MCI models*	*21-22 February 2013*	*Bonn*	*Scientific Community*	*35*	*Europe*
31	*Conference - 133rd EAAE Seminar: Developing Integrated and Reliable Modeling Tools for Agricultural and Environmental Policy Analysis*	*Sebastian Neuenfeldt*	*FADN data mining tool for FADNTOOL to examine and process farm accountancy data for mathematical programming models*	*14-16 June 2013*	*Chania*	*Scientific Community*	*20*	*International*
32	*Conference - 133rd EAAE Seminar: Developing Integrated and Reliable Modeling Tools for Agricultural and Environmental Policy*	*Sebastian Neuenfeldt*	*Using Market Share and Multiplicative Competitive Interaction models to explain structural change in the German agricultural sector*	*14-16 June 2013*	*Chania*	*Scientific Community*	*20*	*International*

	Analysis							
33	*Conference - 133rd EAAE Seminar: Developing Integrated and Reliable Modeling Tools for Agricultural and Environmental Policy Analysis*	*Thomas Heckelei*	*Modelling tools for policy analysis: dimensions of reliability*	*14-16 June 2013*	*Chania*	*Scientific Community*	*120*	*International*
34	*Conference - 133rd EAAE Seminar: Developing Integrated and Reliable Modeling Tools for Agricultural and Environmental Policy Analysis*	*Yinan Zhang*	*Rationalizing calibration of agricultural programming models with a capacity constraint*	*14-16 June 2013*	*Chania*	*Scientific Community*	*20*	*International*
35	*Poster - Wie viel Markt und wie viel Regulierung braucht eine nachhaltige Agrarentwicklung? GEWISOLA Jahrestagung 2013*	*Sebastian Neuenfeldt*	*Erklärung der Spezialisierungsänderungen landwirtschaftlicher Betriebe in der deutschen Landwirtschaft mithilfe von Multiplikativen Wettbewerbsinteraktionsmodellen*	*25-27 September 2013*	*Berlin*	*Scientific Community*	*22*	*Germany*
36	*PhD course*	*Thomas Heckelei. Torbjörn Jansson, Alexander Gocht*	*Econometric and Mathematical Programming Models for Policy Analysis using FADN Data*	*December 9-13, 2013*	*Wageningen*	*PhD students from around the world.*	*20*	*Europe*
37	*Presentation*	*Torbjörn Jansson*	*FADNTOOL – final meeting*	*19 September*	*Brussels*	*Policy Makers*	*30*	*Europe*
38	*Conference paper and presentation*	*Torbjörn Jansson*	*Congress of the European Association of Agricultural*	*August 2014*	*Ljubljana*	*Scientific Community*		*International*

			Economists					

4.3 Report on societal implications

Replies to the following questions will assist the Commission to obtain s indicators on societal and socio-economic issues addressed by projects. The c arranged in a number of key themes. As well as producing certain statistics, the also help identify those projects that have shown a real engagement with wider so and thereby identify interesting approaches to these issues and best practices. Th individual projects will not be made public.

A General Information *(completed automatically when **Grant Agreement***	
Grant Agreement Number:	265616
Title of Project:	Integrating Econometric and Mathematical Programming Models into and Market Analysis Tool using FADN Database
Name and Title of Coordinato	Prof. Konstadinos Mattas

B Ethics
1. Did your project undergo an Ethics Review (and/or Screening)?
• If Yes: have you described the progress of compliance with the releva Review/Screening Requirements in the frame of the periodic/final project reports?
Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achieve*
2. Please indicate whether your project involved any of the following issue box) :
RESEARCH ON HUMANS
• Did the project involve children?
• Did the project involve patients?
• Did the project involve persons not able to give consent?
• Did the project involve adult healthy volunteers?
• Did the project involve Human genetic material?
• Did the project involve Human biological samples?
• Did the project involve Human data collection?
RESEARCH ON HUMAN EMBRYO/FOETUS
• Did the project involve Human Embryos?
• Did the project involve Human Foetal Tissue / Cells?
• Did the project involve Human Embryonic Stem Cells (hESCs)?
• Did the project on human Embryonic Stem Cells involve cells in culture?
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embry
PRIVACY
• Did the project involve processing of genetic information or personal data (eg. hea lifestyle, ethnicity, political opinion, religious or philosophical conviction)?
• Did the project involve tracking the location or observation of people?
RESEARCH ON ANIMALS
• Did the project involve research on animals?

• Were those animals transgenic small laboratory animals?	NO
• Were those animals transgenic farm animals?	NO
• Were those animals cloned farm animals?	NO
• Were those animals non-human primates?	NO
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	NO
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	NO
DUAL USE	
• Research having direct military use	NO
• Research having the potential for terrorist abuse	NO

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	-	1
Work package leaders	-	13
Experienced researchers (i.e. PhD holders)	6	27
PhD Students	8	1
Other	5	4

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	**none**
Of which, indicate the number of men:	

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project?

○	Yes
☑	**No**

6. Which of the following actions did you carry out and how effective were they?

		Not at all effective				Very effective
☑	Design and implement an equal opportunity policy	○	○	○	○	☑
☑	Set targets to achieve a gender balance in the workforce	○	○	☑	○	○
❑	Organise conferences and workshops on gender	○	○	○	○	○
❑	Actions to improve work-life balance	○	○	○	○	○
○	Other:					

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify

☑ No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

○ Yes- please specify

☑ **No**

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

☑ Yes- please specify: Leaflets, website

○ **No**

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

☑ Main discipline[7]: 4.1

☑ Associated discipline[7]: 5.2

○ Associated discipline[7]:

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)*

☑	Yes
○	**No**

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

○ No

○ Yes- in determining what research should be performed

☑ Yes - in implementing the research

☑ Yes, in communicating /disseminating / using the results of the project

[7] Insert number from list below (Frascati Manual).

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	○ ☑	Yes No

12. Did you engage with government / public bodies or policy makers (including international organisations)

- ○ No
- ○ Yes- in framing the research agenda
- ☑ **Yes - in implementing the research agenda**
- ○ Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- ☑ Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
- ○ Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
- ○ No

13b If Yes, in which fields?

Agriculture	☑	Energy		Human rights	
Audiovisual and Media		Enlargement		Information Society	
Budget		Enterprise		Institutional affairs	
Competition		**Environment**	☑	Internal Market	
Consumers	☑	External Relations		Justice, freedom and security	
Culture		External Trade		Public Health	
Customs		Fisheries and Maritime Affairs		**Regional Policy**	☑
Development Economic and Monetary Affairs	☑	**Food Safety**	☑	**Research and Innovation**	☑
Education, Training, Youth	☑	Foreign and Security Policy			
Employment and Social Affairs		Fraud		Space	
		Humanitarian aid		Taxation	
				Transport	

13c If Yes, at which level?

- ☑ Local / regional levels
- ☑ National level
- ☑ European level
- ○ International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	**2**
To how many of these is open access[8] provided?	**0**
How many of these are published in open access journals?	**0**
How many of these are published in open repositories?	**0**
To how many of these is open access not provided?	**2**
Please check all applicable reasons for not providing open access:	
☑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[9]: ……	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		**0**
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	**0**
	Registered design	**0**
	Other	**0**
17. How many spin-off companies were created / are planned as a direct result of the project?		**0**
Indicate the approximate number of additional jobs in these companies:		

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑	Increase in employment, or	❑	In small & medium-sized enterprises
❑	Safeguard employment, or	❑	In large companies
❑	Decrease in employment,	☑	**None of the above / not relevant to the project**
❑	Difficult to estimate / not possible to quantify		

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:*

[8] Open Access is defined as free of charge access for anyone via Internet.
[9] For instance: classification for security project.

Difficult to estimate / not possible to quantify	☑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

○ Y ☑ **No**

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Y ☑ **No**

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

❑	Press Release	❑	Coverage in specialist press
❑	Media briefing	❑	Coverage in general (non-specialist) press
❑	TV coverage / report	❑	Coverage in national press
❑	Radio coverage / report	❑	Coverage in international press
☑	**Brochures /posters / flyers**	☑	**Website for the general public / internet**
❑	DVD /Film /Multimedia	☑	**Event targeting general public (festival, conference, exhibition, science café)**

23 In which languages are the information products for the general public produced?

☑	**Language of the coordinator**	☑	**English**
☑	**Other language(s)**		

***Question F-10*:** Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]

1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

1.3 Chemical sciences (chemistry, other allied subjects)

1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)

1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY

2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]

2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]

2. FINAL REPORT ON THE DISTRIBUTION OF THE EUROPEAN UNION FINANCIAL CONTRIBUTION

This report shall be submitted to the Commission within 30 days after receipt of the final payment of the European Union financial contribution.

Report on the distribution of the European Union financial contribution between beneficiaries

Name of beneficiary	Final amount of EU contribution per beneficiary in Euros
1.	
2.	
n	
Total	