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What we have learned about the use of the FADN in the evaluation of 2014-20 RDPs.

An analysis of the 2019 Annual Implementation Reports

November 2022

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"The definition of the mission, the selection of indicators and the collection of information do not complete the analytical process to be undertaken in order to provide a judgement on an organisation's performance.

It is necessary to make the information usable and useful for the decision-making process".

(Martini and Sisti, Valutare il successo delle politiche pubbliche, 2009)

Acronyms and abbreviations

CEQ	Common Evaluation Question
FA	Focus Area
RDP	Rural Development Programme
MA	Managing Authority
I.X	Impact indicator
R.X	Result indicator
Helpdesk	European Evaluation Helpdesk
FADN	Farm Accountancy Data Network
DiD	Difference-in-difference approaches
CEQ 09	To what extent have RDP interventions supported the improvement of water management, including fertilizer and pesticide management?
CEQ 10	To what extent have RDP interventions supported the prevention of soil erosion and improvement of soil management?
CEQ 14	To what extent have RDP interventions contributed to reducing GHG and ammonia emissions from agriculture?
CEQ 25	To what extent has the RDP contributed to achieving the EU 2020 headline target of reducing the number of Europeans living below the national poverty line?
CEQ 27	To what extent has the RDP contributed to the CAP objective of fostering the competitiveness of agriculture?
CEQ 28	To what extent has the RDP contributed to the CAP objective of ensuring sustainable management of natural resources and climate action?
EC	European Commission
CMES	Common Monitoring and Evaluation System
AIR	Annual Implementation Reports
PSM	Propensity Score Matching

Introduction

This research document aims to contribute to the current debate on the Farm Accountancy Data Network (FADN) and, especially, on how to make it more usable, useful and reliable, for research users as well as for those called upon to plan public interventions and those who, by contrast, are required to evaluate them.

Ten years ago, the Italian National Rural Network published a relevant paper on the use of FADN data for the evaluation of rural development policies and on the performance of these evaluations, providing a broad range of application examples (see Annnex). The report, which was innovative in many regards, had the clear benefit of providing for the first time a general and systematic overview of FADN use.

Taking this as a starting point, the present document examines how the various Managing Authorities of the current 2014-20 Rural Development Programmes used the FADN data for evaluation.

The document is subdivided into three parts:

The first part describes, as indicated by the European Commission, the possibilities of using the FADN in evaluations for the 2014-20 period.

The second part focuses on an examination of how the evaluation teams actually use of FADN data to respond to some of the Common Evaluation Questions, particularly in relation to the issues of profitability and competitiveness, ecosystem restoration and the enhancement and social inclusion, as well as local development. This part refers to the content of chapter 7 of the Annual Implementation Reports for year 2018 (AIR,2019) and accepted by Commission services for each development programme.

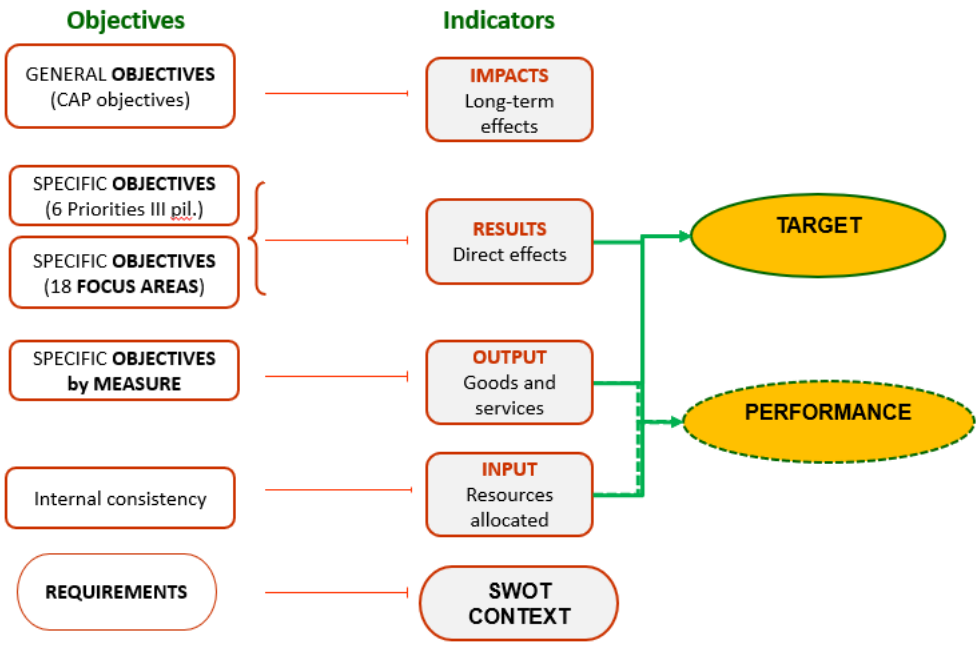
The third part presents a discussion of the results obtained in the previous section following, when possible, the guiding questions offered by the European Commission (European Commission, 2021) on the best uses of the FADN for the evaluation of the RDP, but summarised here in three main areas: variables, samples and methods.

1 Evaluation in the 2014-20 RDPs

1.1 Some of the main elements of Rural Development Evaluation

The regulations for the 2014-20 programming period confirm the importance of evaluations: they provide proof, transparency, learning and responsibilities for the decision-making process and improve the effectiveness, usefulness and efficiency of Rural Development Programme (RDP) interventions. During the various programming periods, the European Commission (EC) introduced, and gradually strengthened rather than improved, a uniform idea for a monitoring and evaluation framework, identifying common ground for evaluation at European level. In this context particular emphasis was given to construct a harmonised system of indicators, at least on a theoretical and methodological level. For 2014-20, the EC strengthened its concept of a "one-size-fits-all" system within the Common Monitoring and Evaluation System (CMES) presented in the Technical Handbook (European Commission, 2017). The structure proposed is well known and is based on a series of common evaluation questions (CEQs) in relation to the 18 programming Focus Areas (FA) to which the evaluator must respond, via the quantification of a set of common indicators, interlinked one each other. To proceed through the 4 classic evaluation steps (structuring, observation, analysis, and judgement) which lead to a response to each common evaluation question, the CMES proposed several tools to be used in evaluation processes, such as the structure of an evaluation plan, and a list of guidance documents. More specifically, the CMES includes an "indicator plan": common in terms of context/impact, output, result, target.

Figure 1: Diagram of the relationships in the system of indicators proposed for rural development



Source: our processing of European Commission data, 2018

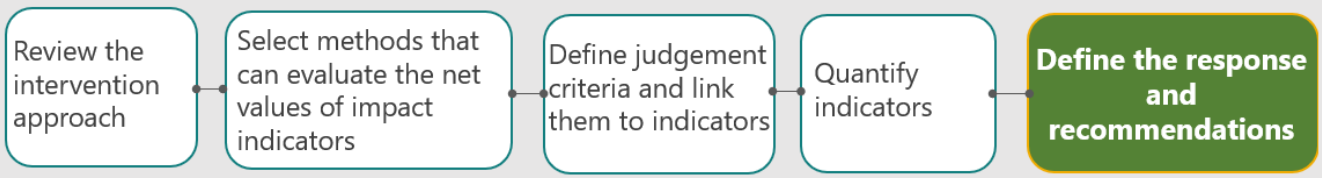
The European Commission has provided detailed files for each of the common indicators and the information can generally be found via well-established data sources, such as Eurostat and the Farm Accountancy Data Network (FADN).

Unlike the previous period (2007-2013), for 2014-20 no interim evaluation was required, and the evaluation results were reported during the course of the programme in chapter 7 of the enhanced Annual Implementation Reports (AIRs) in 2017 and 2019.

In 2017, the AIRs were called to include a quantification of the progress of the RDPs towards the achievement of targets set and to provide an adequate response to the initial series of common evaluation questions, especially those linked to the individual Focus Areas.[1] The Commission services indicate the common result indicators as the primary tool for this quantification and also suggest judgement criteria for interpreting the result indicators and responding to the evaluation questions.

The AIRs presented in 2019, first and foremost, required an update of the findings presented in 2017 and were also obliged to present the evaluation of the impacts of the RDP, by estimating the net values of the impact indicator, interpreting the contributions that RDPs offer to European Union strategies and answering all CEQs, including those relating to European-level targets (CEQ 22-30).

Figure 2: Diagram of the process proposed by the Evaluation Helpdesk to respond to the common evaluation questions



Source: our processing of European Commission data, 2018

To provide support to Member States and evaluators, the European Evaluation Helpdesk (Helpdesk) has offered a number of clarification and guidance documents. In particular, we would like to note the following guidelines:

- "How to prepare for reporting on evaluation in 2017";
- "Approaches to assess RDP achievements and impacts in 2019".

Within the common framework for answering the questions, these documents propose various approaches for responding to the CEQs and suggest various data sources. The guidelines relating to the 2019 AIR, in particular, provide a series of possible techniques to be applied in situations of optimal information availability as well as

[1] For the 2017 AIR, reference is made to common evaluation questions from CEQ 1 to CEQ 22 (See Annex).

when there may be data gaps. The document is organised into several sections for each evaluation question but nevertheless proposes a general pathway for identifying the most suitable method on the basis of data availability (Figure 2) (European Commission, 2018).

Moreover, the Evaluation Helpdesk has provided a series of interactive tools to support evaluations: "Data for the assessment of RDP achievements and impacts" (European Commission, 2020). This tool transfers the logical frameworks developed in the aforementioned Guidelines to an interactive format, providing additional detailed and practical information and recommendations on what to do if there are data gaps in the short and long term, when solutions are necessary. The interactive tool consists of a series of seven logical models that aggregate and cover the 13 common impact indicators.

1.2 Evaluating rural development through the FADN

In evaluation practices, no approach or technique can be identified as a kind of "golden standard", i.e., a primogeniture of sorts in terms of methodological accuracy and orthodoxy; rather, an adequate selection of combinations of techniques must always be sought to estimate solid responses to the evaluation questions. The range of evaluation methods is broad and runs from more "naive" approaches, i.e., the opinion of beneficiaries about the effects of the programme, or the "pre-post" estimate of results for beneficiaries only, to more rigorous experimental and quasi-experimental approaches (European Commission, 2018). The process of selecting methods and techniques is always very complex, it requires solid skills and is based on a number of elements, amongst which the availability and detail of potentially usable information are highly decisive factors, aside from the extent of the resources allocated to data collection.

The Farm Accountancy Data Network has always been – and still is – considered a very useful source for satisfying requests for information in the programming and evaluation of RDPs (European Commission, 2021; Abitabile and Scardera, 2008). In Italy, the collection of data is more complete than in other Member States, and the Italian FADN contains roughly 2,000 items of basic structural, accounting and non-accounting information for every farm and for a number of years. Furthermore, over the years, many changes have been introduced to adjust the FADN to evaluation requirements and, at present, the database makes it possible to use various evaluation models and allows for the possible application of many techniques, as exemplified in table 1, relating to the uses of the FADN in 2007-13 programming.

The Helpdesk's Technical Handbook strongly reaffirms the use of the FADN and confirms its main strengths: i) it is the only common European source of microeconomic data; ii) the accounting principles are the same in all countries; iii) the holdings are selected based on sampling plans at the level of each EU region. However, the Handbook draws attention to some critical issues: i) the survey does not cover all farms; ii) the methodology applied only provides representative data for three aspects (region, economic size and type of farm). The evaluator also needs to take into consideration delays in the provision of FADN data and be aware that the sample may not refer to the entire population; the evaluator needs to clearly recognise which segment of the list of farms benefitting from rural development interventions is included in the FADN survey.

Table 1 - Summary of uses proposed for the FADN in the evaluation of 2007-13 rural development policies

	Context analysis and needs identification	Evaluation of implementation and performance	Evaluation of supporting documents	Change (impact) evaluation
Indicator type	Context Baseline	Result Specific	Specific	Baseline Result (impact)
Approach	Benchmarking	Pre-post analysis	Analytical accounting	Shift-share
	Definition of scenarios	Profiling activities	Streamlined data reporting	Comparison group design
	Parameterisation activities	Selection criteria analysis	Technical coefficients	Statistical matching
Indicator example	Work productivity	Value added	Costs and profitability	Net value added
Technique example	Analysis by clusters Index chains Holding profitability	Ceteris paribus Sensitivity Profiling	Fair compensation Cost-benefit analysis Loss of income and increased costs	Naive Comparison Regressive models PSM and DiD
Reference	Borsotto, 2019 Cagliero *et al*., 2011	Cagliero *et al*., 2021 NUVAL, 2016	Seroglia & Trione, 2002 INEA, 2014	Cisilino *et al*., 2013 EC, 2018a Michalek, 2012
Note/caveat	Information gaps	Rotation of holdings in samples	Representativeness	Satellite samples

Source: Cagliero *et al*., 2021

At the end of April 2021, the Evaluation Helpdesk made available an additional report on the best use of FADN for the assessment of RDP effects on improving the competitiveness of agriculture (European Commission, 2021). This document offers practical solutions and examples drawn from the experience of the various Member States and offers a type of checklist to guide the use of the FADN in rural development evaluation processes, summarised below in three main guiding questions:

- ✓ Are the variables available in the FADN sufficient to estimate the RDPs' effects?
- ✓ What are the requirements for a sample to be used to answer the common evaluation questions?
- ✓ How can the FADN be best used to answer the common evaluation questions?

2. The FADN in evaluation practice

This part of the document presents some examples of the use of the Farm Accountancy Data Network database deriving from concrete evaluation activities and presented in the enhanced AIRs 2019.

More precisely, three experiences are presented below, summarised in a final summary matrix for each one:

- the evaluation processes to answer Common Evaluation Question 27: "To what extent has the RDP contributed to the CAP objective of fostering the competitiveness of agriculture?" and focus on the quantification of the effects of entire programmes on the extent of competitiveness, by estimating impact indicators;
- several evaluation processes relating to environmental aspects, where the FADN is used, albeit in only a few cases, to answer a number of common evaluation questions at Focus-Area level ("To what extent have RDP interventions supported the improvement of water management, including fertilizer and pesticide management?"; "To what extent have RDP interventions supported the prevention of soil erosion and improvement of soil management?"; "To what extent have RDP interventions contributed to reducing GHG and ammonia emissions from agriculture?") and also an overall RDP-level question "To what extent has the RDP contributed to the CAP objective of ensuring sustainable management of natural resources and climate action?";
- certain evaluation processes that are of more concern to matters pertaining to local areas, in relation to the interpretation of any effect of the RDPs on the reduction in the number of people living below the poverty line, where the FADN was used especially to interpret results relating to disadvantaged areas; the common evaluation question is "To what extent has the RDP contributed to achieving the EU 2020 headline target of reducing the number of Europeans living below the national poverty line?".

2.1 Evaluating outcomes in terms of competitiveness

The interpretation of results relating to evaluations of changes attributable to the application of Italian RDPs in terms of competitiveness was generally carried out to answer Common Evaluation Question 27: "**To what extent has the RDP contributed to the CAP objective of fostering the competitiveness of agriculture?**". The impact indicators proposed by the Commission services to provide an answer to this question are:

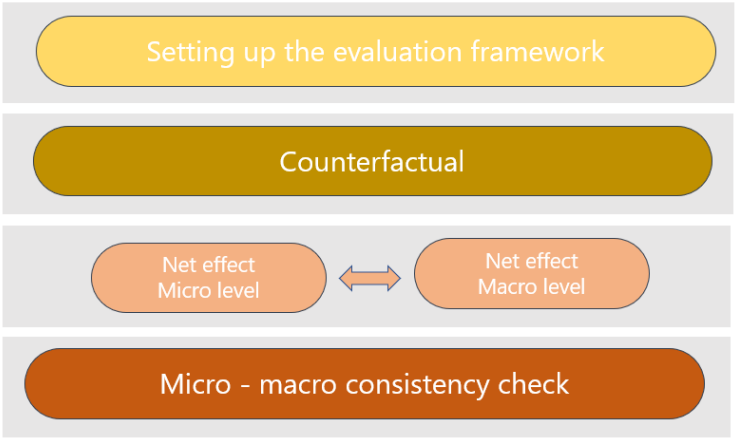
- ✓ I.01 agricultural entrepreneurial income;
- ✓ I.02 agricultural factor income;
- ✓ I.03 total factor productivity in agriculture.

As is well-known, these indicators, which are used as information to describe the context[2] in which the RDPs operate, are already available and calculated at macro level, i.e., by sector, for each Member State by the national statistics offices (like the Economic Accounts for Agriculture). However, it is evident how these aggregate estimates cannot be directly associated with RDP interventions and, therefore, they should not be used in this form in evaluation processes. Any changes in these indicators at aggregate level and in relation to the context could indeed represent only a gross indication of a change and one which is likely caused by several factors; in this sense, they are not very useful to analyse the actual effects of RDPs.

Therefore, impact indicators I.01, I.02 and I.03 should be calculated following a procedure that can isolate any effects of rural development interventions, starting from an interpretation at "micro" level, i.e., on farm basis, for a group of beneficiaries and for a control group (non-beneficiaries). The Technical Handbook indicates the FADN as the most significant source and suggests using this database for the quantification of the comparison in terms of income and productivity, according to the impact indicators, for estimating the change induced by the Programmes.

In summary, it is suggested that the micro-level FADN data is cross-referenced with beneficiaries information from administrative data system; then the outcomes will be compared with macro-level trends, following a multi-level approach (see box below).

BOX - A simplified description of the logical flow of micro and macro estimation levels

The figure to the right summarises and simplifies the four-level estimation framework for the impacts of RDPs proposed by the Helpdesk. In the **first level**, the evaluation framework needs to be set up, requiring the definition of the positioning of impacts from the perspective of intervention, available indicators and the unit on which to perform the evaluation. The **second level** identifies options for the possibilities of proceeding with evaluation comparisons, in light of constraining factors. The **third level** refines options at micro and macro levels to evaluate any net effects. Lastly, the **fourth level** checks the consistency of the analysis at micro and macro levels to validate the results.	

Source: European Commission, 2018

[2] The context indicators are listed in the Technical Handbook and in certain cases are directly associated with CAP impact indicators. In this case, the context indicators are: C.25 Agricultural factor income; C.26 Agricultural entrepreneurial income; C.27 Total factor productivity in agriculture

Matrix 1 summarises the FADN use in the Italian AIRs by the various evaluation teams and groups the RDPs evaluated into four sets considering indicator quantification processes and any results obtained (AIR, 2019).

In general, a significant effort is required to answer the Evaluation Question by quantifying these common impact indicators using FADN data. However, several evaluators claim that it is not possible to quantify any effect in the current project adoption phase; others have not used FADN data to calculate the indicators and will not use them in the coming years (- indicators not quantified).

Matrix 1 – Method of use of FADN data in processes of answering common evaluation question 27 and quantifying correlated indicators in Italian RDPs

RDP	I.01	I.02	I.03	Indicator or proxy	Notes
Valle d'Aosta	^	^	^	-	Qualitative approach
Piedmont	*	*	*	-	
Lombardy	X	X	X	Output/costs; VA/UL	Counterfactual approach
A.P. Trento	X	*	*	-	-
A.P. Bolzano	X	*	*	RN	-
Veneto	X	X	X	Output/costs; VA/UL	Counterfactual approach
Friuli V.G.	-	-	-	-	-
Liguria	-	-	-	VA/ UL	Benchmarking
E. Romagna	X	X	X	Output/costs; VA/UL	Counterfactual approach
Tuscany	^	^	-	-	-
Umbria	^	^	-	-	-
Marche	^	^	-	-	
Lazio	*	*	-	VA/UL	EU FADN database
Abruzzo	X	X	X	-	Statistical matching
Molise	-	-	-	-	-
Campania	^	^	-	-	-
Puglia	^	^	-	-	-
Basilicata	-	-	-	-	-
Calabria	X	X	X	-	Statistical matching
Sicily	*	*	-	-	PSAWEB
Sardinia	X	X	X	-	Statistical matching
NRDP	*	*	*	-	-

Source: Cagliero *et al*., 2021

*X full quantified; * Context update; ^ Planned to be done; - Not quantified*

In six of the regions (labelled with the ^ symbol), indicator quantification is only planned, and it is possible to observe a sort of will to use FADN data for this purpose, despite some critical issues. For example, according to these evaluators, estimates should be made over a sufficient period to be able to evaluate the effects of the RDP and this has not yet been possible. In four situations (marked with *), the evaluators have essentially estimated

a gross change in the economic context, without evaluating the direct contribution of the RDPs. Instead, a - sign indicates that FADN was not taken into account in the evaluation processes.

In the remaining eight regions (marked with X), the quantification of indicators I.01, I.02 and I.03 was carried out using FADN data, albeit with different procedures and with the identification of a number of critical issues, which range from the capacity to also represent small-sized holdings to issues of underestimating the effects on livestock farms. In summary, the following methods were employed to make use of FADN data:

- ✓ use of FADN to estimate both beneficiary and non-beneficiary groups, based on the procedures carried over from previous programming periods (Sardinia, Calabria and Abruzzo);
- ✓ use of FADN to estimate the target group (situation with RDP) and estimation of control group (without RDP) based on 2007-13 experience (Lombardy and Emilia-Romagna);
- ✓ use of FADN to estimate the control group (without RDP), while beneficiaries' data (situation with RDP) are gathered by direct survey (Veneto);
- ✓ use of FADN to estimate only economic trends in the various sectors, while monitoring data, supplemented by a direct survey, are used to estimate the RPD's effects (Trento and Bolzano).

2.2 Evaluating outcomes on environmental issues

Five evaluation teams made use of FADN data during evaluations on environmental matters, as summarised in Matrix 2.

In three cases[3], (Abruzzo, Calabria, Sardinia), the FADN was used with reference to Focus Area 5d (CEQ 14 "To what extent have RDP interventions contributed to reducing GHG and ammonia emissions from agriculture?") or to provide an answer to evaluation question CEQ 28 at programme level "To what extent has the RDP contributed to the CAP objective of ensuring sustainable management of natural resources and climate action?".

In relation to CEQ 14, the FADN was used in the calculation of result indicators R18 (Reduced emissions of methane and nitrous oxide) and R19 (Reduced ammonia emissions) in a similar way, i.e., to build a comparison group in relation to a sample of beneficiaries deriving from Italian Agricultural Information System (SIAN) data. More specifically, the FADN information used regarded the livestock density, to which then apply the official emission coefficients for each animal category (EF - Emission Factor, from the ISPRA [Italian Institute for Environmental Protection and Research] national emissions inventory). The CH4 emissions were estimated for all livestock of beneficiaries.

To respond to CEQ 28, regarding the repercussions of the entire Programme on sustainable management of natural resources, the evaluators constructed a dataset of average irrigation volumes for each crop deriving from the FADN database, in order to determine the average irrigation requirements of each crop in the region.

[3] It is worth mentioning that the same independent evaluator was involved

In Piedmont, the FADN was used to identify a sample to be subjected to a direct survey, relating to topics on the use of fertilizers through campaign reports (CEQ 09 "**To what extent have RDP interventions supported the improvement of water management, including fertilizer and pesticide management?**").

Lastly, in relation to CEQ 10 (**To what extent have RDP interventions supported the prevention of soil erosion and improvement of soil management?**), in Bolzano the evaluation team used FADN economic information to reprent the context in which farms are actually operating and the actual role of farmers. Through the economic FADN indicators the evaluator highlighted how the mountain farmers are becoming increasingly producers of environmental services that benefit society. These services need non-intensive animal and crop suistanible management and by the maintenance of the proper ratio between livestock units reared and used land.

Matrix 2 - FADN utilisation experience in evaluation processes on environmental topics in Italian RDPs

RDP	Evaluation question	Priority and FA	Common indicators	Notes
Abruzzo	CEQ 14 CEQ 28	5D / GHG RDP	R18; R19 (EF) I10	Counterfactual approach Average irrigation volumes
Calabria	CEQ 14 CEQ 28	5D / GHG RDP	R18; R19; I10 I10	Counterfactual approach Average irrigation volumes
Sardinia	CEQ 14 CEQ 28	5D / GHG RDP	R18; R19; I10 I10	Counterfactual approach Average irrigation volumes
Piedmont	CEQ 09	4B	Chemical input (campaign report)	FADN sample as the basis for selecting observation group
A.P. Bolzano	CEQ 10	4C	Net income	Environmental role of animal husbandry in the mountains

Source: our processing of 2019 AIR data

2.3 Evaluating outcomes on rural areas

With regard to the so-called "local development", linked to Priority 6 – Social inclusion and economic development, only a limited number of evaluation teams used FADN data. When they did so, the FADN was used almost exclusively to answer CEQ 25 "**To what extent has the RDP contributed to achieving the EU 2020 headline target of reducing the number of Europeans living below the national poverty line?**".

There are relatively few evaluation experiences based on the FADN and they are all very similar and performed by the same evaluator (see Annex I). The focus of the analyses is based on the interpretation of the intervention logic in relation to the topic in terms of poverty. The evaluation is centred around the application of a bunch of relevant measures in particular risk areas, such as disadvantaged mountain areas.

The FADN is used to determine the role and implementation of Measure 13 (Compensation in favour of areas subject to natural constraints or other specific constraints) in Areas of natural or other specific constraints. The analysis concerned both the rate of coverage of the intervention on potential beneficiary farms and an estimate of the annual average contribution per farm (Matrix 3). This estimate is calculated by the change on work

profitability indicator. On average, the estimated value for this indicator fluctuates between 20% and 10% in the regions observed.

Matrix 3 - FADN utilisation experience in evaluation processes on local development in Italian RDPs

RDP	CEQ	Priority	Measure	Specific indicator
Valle d'Aosta	CEQ 25	P6	13	Support/income – work profitability
Liguria	CEQ 25	P6	13	Support/income – work profitability
Tuscany	CEQ 25	P6	13	Support/income – work profitability
Umbria	CEQ 25	P6	13	Support/income – work profitability
Marche	CEQ 25	P6	13	Support/income – work profitability
Campania	CEQ 25	P6	13	Support/income – work profitability

Source: our processing of 2019 AIR data

3 Some concluding remarks

The evaluation of the effects of Rural Development Programmes requires consistent and highly specific skills and knowledge. The Programmes are very complex and the implementation level could varies considerably. Furthermore, the estimation of an indicator, which determines the net effects of an intervention, requires a significant amount of effort in situations in which data are scarce, the RDP absorption is low, or when sufficient time and resources have not been dedicated to the performance of the evaluation (European Commission, 2018).

This final part presents an initial discussion of the results obtained in the previous section following, when possible, the guiding questions offered by the EC (European Commission, 2021) on the best uses of the FADN for the evaluation of the RDP, which has already been mentioned in Part I above.

We should point out a limitation in the analysis of the current use of the FADN for evaluations in Italy, which is primarily due to the application of many different methodologies. This criticism can also be identified in the European context, as FADN usage cases prove to be dissimilar and do not allow for any comparability in the overviews provided by the Evaluation Helpdesk (European Commission, 2021). Because this huge variability, as summarised for example in Matrix 1 above, it is difficult to express a general judgement on these evaluations or conduct a meta-evaluation exercise. However, the proposal analysis at Member-State level, albeit fragmented and complex, could be an interesting in-depth examination and the next potential step of this study.

3.1 Are the variables available in the FADN sufficient to estimate the RDPs' effects?

The analysis of the evaluations underscores the importance of a counterfactual approach to perform the assessment, by comparing groups of beneficiaries and non-beneficiaries (see chapter 2.1). From this perspective, detailed information available at farm level in the most complete manner possible becomes necessary. The majority of Italian evaluators highlight that the FADN may be considered the most appropriate and usable source in relation to economic issues (see CEQ 27), especially if combined with other sources. This other information may derive from official statistical data, such as ISTAT; or may refer to data of an administrative nature. In rare cases, recourse was made to direct surveys. However, with regard to the environmental and local development priorities using the FADN is certainly less common and the evaluators primarily avail of other sources, especially direct surveys.

As a result, in relation to the capacity of the variables collected by the FADN to be sufficient to perform evaluations, it is necessary to reflect on two different points. The analysis presented in Part 2 shows how the FADN was used, primarily, for evaluations on competitiveness and, in this case, the variables are judged to be adequate to determine both the common indicators proposed by the EC services as well as any additional indicators (e.g., Output/Costs) proposed directly by the evaluators, but not addressed here. However, on the other hand, the variables collected by the FADN survey were not deemed sufficient to perform evaluations on other topics, such as climate change or quality of life in rural areas.

The nature and history of the FADN must be taken into account. FADN is a repository based on microeconomic data and, therefore, it can lead to estimate income and any changes triggered in farms as regards economic trends and business decisions, using several methodological approaches, from sensitivity analyses to positive mathematical or econometric techniques. The development of research with FADN data today is not so much methodological, but thematic, with the aim to address other relevant farm issues besides economic ones, such as innovation, training and, above all, environmental and social sustainability, or area-specific, such as areas with environmental constraints. These issues represent also the challenges for the future CAP and, therefore, will increasingly be at the centre of evaluation processes (Cagliero *et al*., 2019; Poppe and Vrdoljak, 2018).

In this light, a number of evaluations using FADN on non-economic issues have already been carried out in Italy.

Arzeni *et al*. (2021), as well as Cristiano and Proietti (2019), for example, investigated the possibilities of using FADN variables in the evaluation of Italian farm innovation paths. Cisilino *et al*. (2013; 2019), on the other hand, analysed the possible assessments on more environmental topics, as well as organic agriculture; while other authors have focused several studies on the overall farm sustainability (Lombardy Region, 2012; Borsotto *et al*. 2013; Verrascina *et al*. 2020). Furthermore, the FADN can provide basic knowledge about local production systems at microeconomic level and about farm strengths and weaknesses. This not only makes it possible to identify or verify potential needs that require public support, but also to provide a reference basis for subsequent programming and evaluations. From this perspective, certain authors (Cagliero *et al*., 2018 and Seroglia and Trione, 2002) tried to study the impacts on mountain areas of compensation for holdings located in disadvantaged areas, not only in economic terms, but especially in relation to an entrepreneur's behaviour, and also to offer a territorial assessment of the intervention.

As we move towards the next programming phase, in particular, it is clear that there are significant opportunities to improve data use for these topics, with respect to the partial underuse that has taken place in the past (European Commission, 2021), and the FADN improvement proposals from the Commission move in this direction, towards the FSDN (Farm Sustainability Data Network) implementation (Poppe and Vrdoljak, 2016; Vrdoljak and Poppe, 2021).

Lastly, the issue of data quality must be strongly considered (European Commission, 2021). As it is well known, the data should be available, pertinent and consistent, in addition to complete and precise. There should be no issues with FADN data quality in terms of comprehensiveness and consistency over time, since sophisticated quality control is performed regularly.

3.2 What are the sample requirements to be used to answer the CEQs?

Considering the 2019 Italian AIRs, it is possible to aggregate the main findings on the use of FADN at least with reference to CEQ 27, where more indications are available, as well as several critical points and possible improvements; a summary table is shown below (table2).

Several evaluators in 2014-20 used the FADN data for the identification of comparison groups, beneficiary and control, following a counterfactual approach. These process of composition of the samples were established

with different approaches (see also chapter 2.1): use of FADN to both groups, use of FADN as benchmarking, use of FADN only for one of the two groups (beneficiaries or control), use of FADN matching with administrative data, use of FADN indications from previous programming, etc.. However, in general, the evaluators very often highlight a critical issue in the number of observations contained in the FADN, especially to proceed with in-depth analyses in terms of type of farm, type of product or economic size. For example, focusing on smaller holdings could be very difficult using only the FAND, without implementing the number of observations with ad hoc surveys. In these cases, especially if the research is to be segmented significantly, the FADN sample loses consistency and stability and is no longer deemed usable.

Table 2 – Summary of FADN uses in answering CEQ 27: critical issues and possible improvements

Use	Critical issues	Possible improvements
Construction of groups addressed and similar control groups	Low number of beneficiary farms	Methods for extension of the sample Activation of satellite samples
	FADN sample not aligned with the beneficiary population	Activation of satellite samples
Use of deep time series (>10 years)	Rotational nature of the panel	Activation of satellite samples
Analysis and comparison of evolution in context	Estimate of very dirty effects and not the actual contribution of the RDP	Benchmarking on statistical data
Estimate and application of technical coefficients (e.g., economic return)	Need for comparison with administrative data	Matching with administrative archives Construction of administrative archives based on compatible methodologies

Source: Cagliero *et al*., 2021

The solutions applied, or suggested in the literature and by EC, primarily regard the possibility of **extending the FADN sample** using various methodologies, such as the databases from neighbouring regions or the activation of so-called satellite sample (Cagliero *et al*., 2011; European Commission, 2020). These are complex proposals in terms of selection and validation procedure, in the first case, or costly, in the second one.

A simpler, albeit less complete in terms of consistency, alternative are simplified gather methods. It means procedures based on FADN methodology and applied for each farm when filling in a format for the public administration (e.g. a support application form). (Vaccaro *et al*., 2022). An application named *Bilancio Semplificato* (Financial Statement), and made available by CREA, already adopts a procedure for gathering farm data in a comparable way to FADN survey and, therefore, provides also a bunch of indicators, analogous to the FADN ones, to answer the evaluation questions (https://bilanciosemplificatorica.crea.gov.it).

With a view to expanding the FADN regional sample, a first suggested solution is to increase the sample size refers to the inclusion of “nearby” RDPs. Considering other regions in which a similar measure is applied could

represent an interesting opportunity. In this process, some caveats must be considered: i) using data only from farms that participate in very similar measures in terms of eligibility criteria; ii) including the farm's location as a control variable; iii) taking into account that there will be a distortion in results, due to a repositioning of the programme's effect (European Commission, 2021). On the other hand, the construction of a satellite design, as a system integrating samples within the FADN, could make the evaluation analyses more robust. This could be especially useful when there is a lack of information on certain topics or specific interventions. As a result, the satellite samples should consist of those farms that belong to the regional list of beneficiaries of a specific measure. However, it should be noted that the satellite sample cannot improve the statistical representativeness of the base sample, as it does not respect the same stratification criteria. Therefore, it must be considered an "oriented (or guided) sample" aimed at gathering information on the beneficiaries of the RDP which can then be compared with the total population of farms represented by the FADN survey

Extending the FADN sample

The approach suggested by the EC is to extend the number of observations, in total and for farms by type, by incorporating into the analysis units found in other similar regional situations.

For example, in the case of Germany, in an FADN sample identified in Bavaria, holdings present in the Baden-Württemberg FADN sample could also be incorporated in order to extend the sample with additional observations. However, this may be done only when the RDPs do not substantially differ in their implementation, for example in type of beneficiary or in eligibility criteria, and a certain similarity in the characteristics of the farms between the regions would also be necessary.

In the new implemented data set, obviously, it must be included a control dummy variable that indicates in which area of the programme a given farm is located. -

If there are still not enough observations even after adding the observations of the nearby region, the evaluators could decide to extend the analysis field to other Focus Areas as well. For example, to analyse the effects under FA 2A, they could extend the observations to farms supported in FA 3A. Such a decision, albeit unorthodox, is still considered more effective than giving up on a quantitative analysis.

European Commission – Directorate-General for Agriculture and Rural Development – Unit C.4 (2021): Working Document 'Best use of FADN for the assessment of RDP effects on fostering the competitiveness in agriculture – Working Package 3 'Assessment of RDP effects on fostering the competitiveness of agriculture' - Thematic Working Group no 8 'Ex post evaluation of RDPs 2014-2020: Learning from practice'. Brussels

Note: In Italy, a similar approach was used by Seroglia & Trione (2002) to estimate fair compensation for compensatory allowances in Valle d'Aosta region.

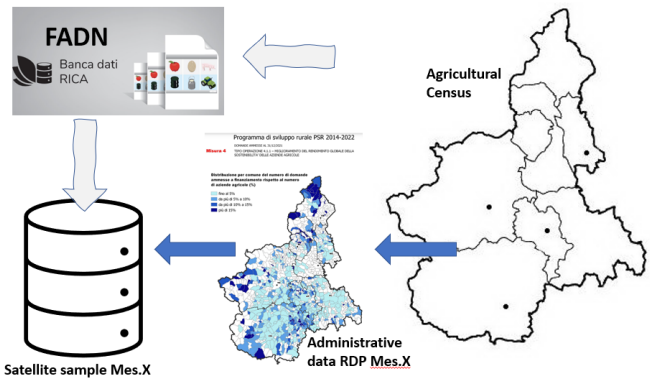
The FADN satellite system

Starting from mid-2000, INEA [Italian National Institute of Agricultural Economics] developed a specific proposal aimed at considering the possibility of using the FADN to evaluate agri-food policies and rural development interventions. The proposal was based on a sample system defined as satellite, a system consisting of multiple samples linked to each other to meet the evaluation information needs.

The hypothesis takes the regional FADN sample, which has been statistically representative since 2003, as a base sample, constituting the reference for all other possible satellites. According to the satellite design, other (satellite) samples with lower numbers, each of which is specific to particular public interventions, revolve around the regional sample. Therefore, the satellite samples represent the beneficiary units of a given intervention, deriving from administrative archives, and useful information for the evaluation is collected on these units in a manner similar to that available on the regional FADN base sample units.

The identification of appropriate satellite samples offers a dual advantage: the possibility of carrying out spatial analyses on the one hand and of also being able to properly develop dynamic type analyses on the other.

Representation of the FADN satellite system



	Cagliero R., Cisilino F., Scardera A. (2010), L'utilizzo della RICA per la valutazione di programmi di sviluppo rurale [Use of the FADN for the evaluation of rural development programmes], Working document, National Rural Network, Italian Ministry of Agricultural, Food and Forestry Policies

A second approach indicated to address the limitations described is the possibility of **matching FADN** with data from other sources, such as secondary sources, e.g. ISTAT, or administrative sources, e.g. the Paying Agencies or the Managing Authority. Considering different databases is always a challenge that the evaluator needs to be ready to face. This matter has resulted in increasing literature on appropriate methods (Sinabell and Streicher, 2004; Michalek, 2012; European Commission 2021). In combining various sources to perform the evaluations, actually comparable data are required to significantly improve the validity of the studies. In this light, to integrate the data belonging to various sources, it would be advantageous to identify ex ante the same definition of variables and indicators, but this represents one of the main challenges. As regards the FADN and monitoring or other administrative sources, we often face a different definition/range/classification for the same information (Cisilino et al. 2013; European Commission, 2020). In addition, we also observe data recording problem, since in administrative information system some information may be not compulsory and/or certain fields sometimes could be not completed. Those issues restrict the number of variables that can be used for statistical analyses (counterfactual analysis, statistical matching) and the low level of matching in the definition of variables entails a broad use of proxy variables. From this perspective, greater attention to information integration and harmonisation starting from the initial programming phases should be the objective. This could be achieved through the collaboration of all parties involved (Managing Authorities – administrative information systems, evaluators, the research sector).

Another important aspect to consider is the possibility of performing analyses on sufficiently deep time series of more than 10 years, thanks to the continuity of the survey over time. This possibility is of significant interest for evaluations, but critical issues should also be highlighted, since the rotational nature of the FADN panel entails a significant number of holdings being added or removed over time. The solution that is most often proposed in the literature is to identify and maintain some specific observations, additional to the sample, with the aim to increase continuity of farms which would otherwise be abandoned (Abitabile and Scardera, 2008; Cagliero et al., 2011). This could guarantee a **constant sample of observations** for an adequate period for evaluation (pre- and post- intervention, including difference-in-difference approaches).

3.3 How can the FADN be best used to answer the CEQs?

The availability of standardised data sets (such as ISTAT, FADN, IACS[4]) is a significant benefit for the application of quantitative methods and the FADN data has been confirmed as highly useful. However, their usefulness is influenced by certain critical points that must be overcome, which has been presented in the section above.

The range of methodologies that may be applied to evaluate impacts is rather broad. However, selecting a method for a given RDP or a given intervention is not always easy, as the results may be sensitive to the context, hypotheses and methods applied. The Commission services have proposed a logical model that provides a guide to selecting from the various evaluation approaches (Figure 3).

The first critical question is whether the evaluator has access to data on beneficiary and non-beneficiary farms and if this information makes it possible to perform an adequate comparison between these groups, to properly apply counterfactual analysis methods; otherwise, if these data are not available, econometric quantitative methods, which are deemed more accurate, cannot be applied. In this situation, the interpretation of the impacts of the RDP must be based on more qualitative approaches or approaches with "naive" comparisons, or "pre-post" interpretation models only on beneficiaries, if data relating to the situation before and after the intervention in the supported farms are available.

Consistent with EC indications and in a manner that is substantially shared in the evaluation reports, it can be affirmed that counterfactual studies are recommended as the most appropriate to respond to the Common Questions, particularly for CEQs relating to the topic of competitiveness; while regarding environmental or local development, the information are too limited to led to a judgement, even merely an approximate one. The attributes of the FADN survey and the possibility of constructing comparison groups at farm level represent however a sort of potential "golden standard", once the critical issues trimmed out previously have been resolved.

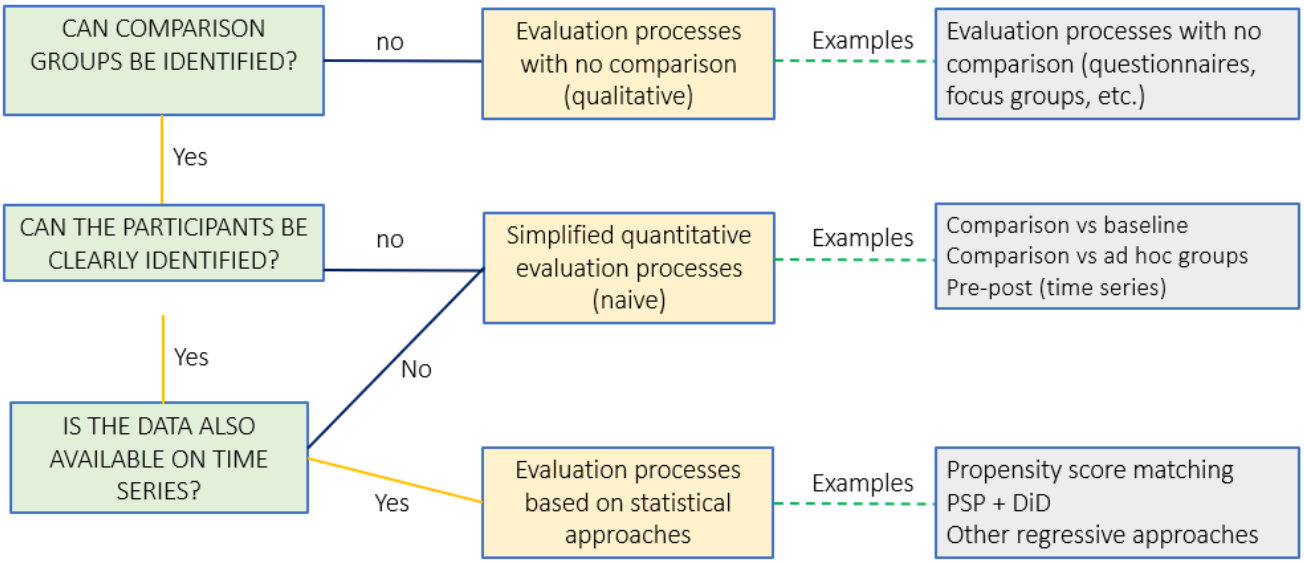
In other cases, to estimate the economic performance of subsidised farms, the evaluators established "technical coefficients" based on FADN data (Cagliero *et al*., 2011); the parameters estimated on regional conditions, with focus by production orientation or other criteria, are then applied to administrative data, containing generally structural but not economic information. Although this approach is *naive* to a certain extent, it represents an initial effort towards the possibility of matching administrative records with the FADN. This cross-reference could be the most appealing proposal present in the literature to improve the possibility of using the FADN in evaluation processes (European Commission, 2020, 2018, 2021).

Lastly, another relatively widespread use of the FADN was the estimate of the economic evolution of the regional context, i.e., the update of context/impact indicators, to highlight changes at local area or sector level (please refer to Matrix 1, in Part 2.1). However, we know that this estimation is not capable of fully understanding and

[4] Integrated Administration and Control System. European Union (EU) countries are responsible for the management and control of payments to farmers in their country on the basis of the "shared management" principle. The main component of the payment management system is the integrated management and control system (IMCS) (https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/financing-cap/financial-assurance/managing-payments_it)

explaining the contribution made by the RDPs to these changes observed. The result is a rough and insufficient quantification of the intervention. Nevertheless, this information may be used as a point of reference within a more refined analysis process.

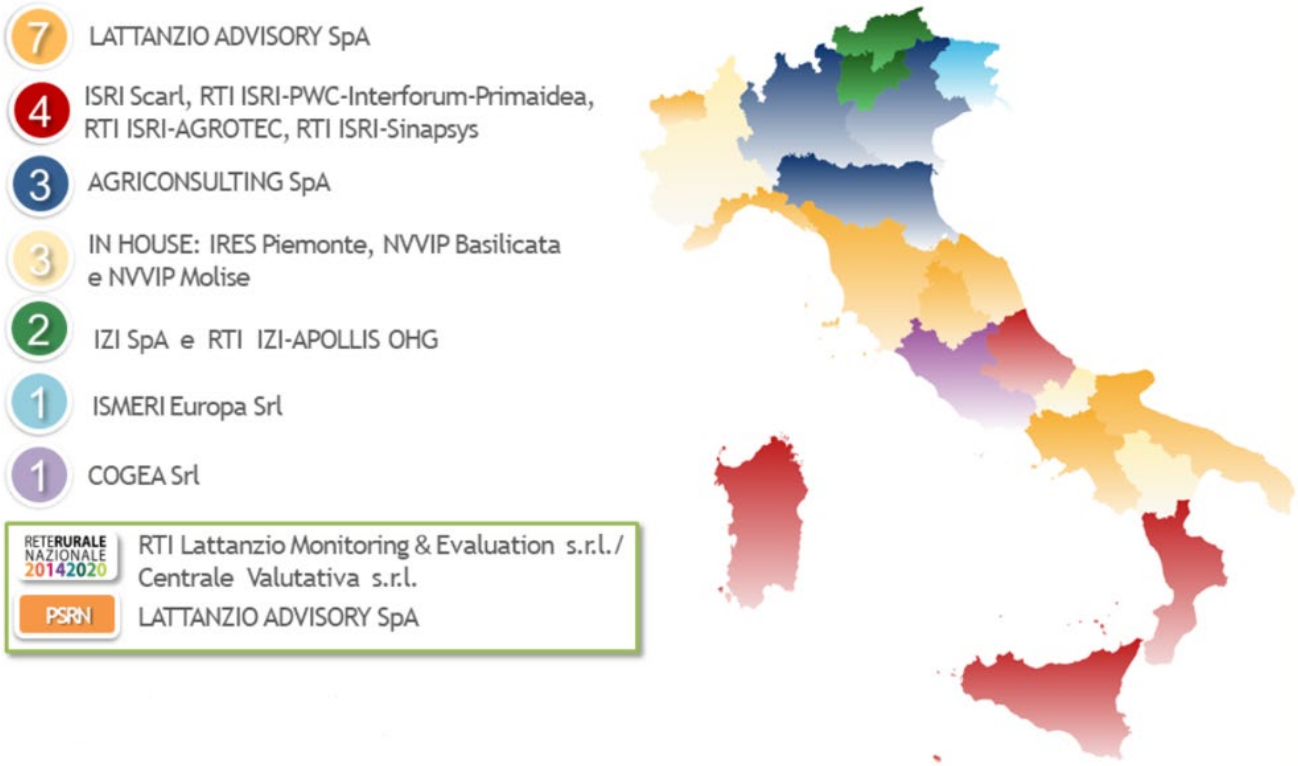
Figure 3 - Simplified logical model for setting up an evaluation process



Source: European Commission, 2018

ANNEXES

Annex I - 2014-2020 RDP evaluation services in Italy



Source: Rural Network

Annex II - The priorities and focus areas identified for 2014-20 programming

Priority 1: Knowledge transfer and innovation

FA 1A - Fostering innovation, cooperation and the development of the knowledge base in rural areas;

FA 1B - Strengthening the links between agriculture, food production and forestry and research and innovation;

FA 1C - Fostering lifelong learning and vocational training in the agriculture and forestry sectors.

Priority 2: Farm profitability and competitiveness

FA 2A - Improving the economic performance of all farms and facilitating farm restructuring and modernisation;

FA 2B - Facilitating entry of adequately skilled farmers into the agricultural sector and in particular generational renewal.

Priority 3: Organisation of the agri-food chain and risk management

FA 3A - Improving competitiveness of primary producers by integrating them better into the agri-food chain;

FA 3B - Supporting farm risk prevention and management.

Priority 4: Restoring, preserving and enhancing ecosystems

FA 4A - Restoring, and preserving and enhancing biodiversity;

FA 4B - Improving water management;

FA 4C - Preventing soil erosion and improving soil management.

Priority 5: An economy that is efficient in terms of resources and resilient to climate change

FA 5A - Increasing efficiency in water use by agriculture;

FA 5B - Increasing efficiency in energy use in agriculture and food processing;

FA 5C - Facilitating the supply and use of renewable sources of energy;

FA 5D - Reducing greenhouse gas and ammonia emissions from agriculture;

FA 5E - Fostering carbon conservation and sequestration in agriculture and forestry.

Priority 6: Social inclusion and economic development

FA 6A - Facilitating diversification, creation and development of small enterprises and job creation;

FA 6B - Fostering local development in rural areas;

FA 6C - Enhancing accessibility to use, and quality of, information and communication technologies (ICT) in rural areas.

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