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Data requirements for evidence-based evaluation of EU funded interventions

What types of data are needed for evidence based impact evaluation? What are the implications for data management? What are the implications for public authorities?

Rolf Bergs

Contents

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- The need for accountability in EU rural development policy
- What is empirical evidence?
- The scope and character of interventions: some examples
  - Major types of impacts
  - How to estimate those impacts
  - Data requirements
- Data management

The need of accountability in EU rural development policy

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- Evaluation is considered as the judgement on the utility of a public intervention *(to justify public expenditure)*;

- The establishment of impacts needs to be based on empirical evidence, otherwise, justification of the intervention becomes questionable;

- However, the effort of proving empirical evidence needs to be justified by the benefit of insight into impacts of public intervention *(decreasing marginal utility, measurement itself has a direct influence on the programme results; the method can only be as good as the data feeding into the system)*

What is empirical evidence?

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- Capable of being verified or disproved by observation or experiment
- Evidence of impact of many interventions can be established by direct observation (e.g. a survey, causal relationship or case studies)
- Impacts of some sorts of intervention cannot be directly observed *(e.g. counterfactual)*
- Some interventions exhibit distributions suitable for counterfactual analysis, others not
- Representativeness: trade-off between reliability of results and cost of establishing results
- The strength of evidence varies with the quality of data (validity, representativeness) and the estimation approach

The scope and character of EU rural development interventions

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- The scope of EAFRD is broad (e.g. compared to ERDF) *(from vocational training of farmers to flood protection)*

- The character is less focused on strengthening immediate economic competitiveness (growth and employment) but to a large extent on sustainability and safeguarding welfare (e.g. agri-environmental payments, village renewal etc.)

An example: Comparing measures 111 (vocational training) and 126 (disaster prevention) I

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M 111

"Items": People

Many, rather homogenous units with little unit costs of treatment

M 126

Items: Large infrastructure

Few, rather heterogeneous units with high unit costs of treatment

An example: Comparing measures 111 (vocational training) and 126 (disaster prevention) II

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- Core evaluation question for M 111: Did the farmer benefit from the training? *> Compare the economic situation of the farmer with and without training*

- Core evaluation question for M 126: How much has the damage risk declined? *>Reduction of the occurence of flooding*

<u>In both cases there is the problem of unobservables: We can neither observe the trained farmer being untrained at the same time nor the future of floods along the river</u>

An example: Comparing measures 111 (vocational training) and 126 (disaster prevention) III

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Simple (naive) approach:

- comparing the situation of the farmer before and after training (disregarding other external impacts);
- counting flooding disaster occurence before and after construction of dams and retention basins

An example: Comparing measures 111 (vocational training) and 126 (disaster prevention) IV

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Evidence-based approach:

- Constructing a control group out of similar units from the rather homogenous universe of farmers > *advantage: large numbers, disadvantage: large data requirements to specify the control group realistically*
- Assessing the reduction of flooding disasters in terms of money saved (risk=cost) > *advantage: knowledge about the distribution of floods in the past and knowledge about specific damage functions; disadvantage: uncertainty about impacts of climate change etc. on future flood occurence*

Another example: Village renewal (M 322) I

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Character of this measure:

- The purpose is going beyond income, competitiveness and sustainable development: improvement of the quality of life

- Impacts can be directly observed but are rather described by perception (subjective !)

Another example: Village renewal (M 322) II

- The strong variation of the character of villages (location, size, infrastructure, GDP, economy) makes every of them unique. *> a counterfactual analysis appears inadequate*.
- There are neither official statistics nor monitoring data on quality of life at village level. The establishment of impacts is best to be assessed by surveys and subsequent descriptive statistics *> Advantage: technically simple, (dis)advantage: The impact analysis is affected by the subjective bias.*

Some practical examples illustrated

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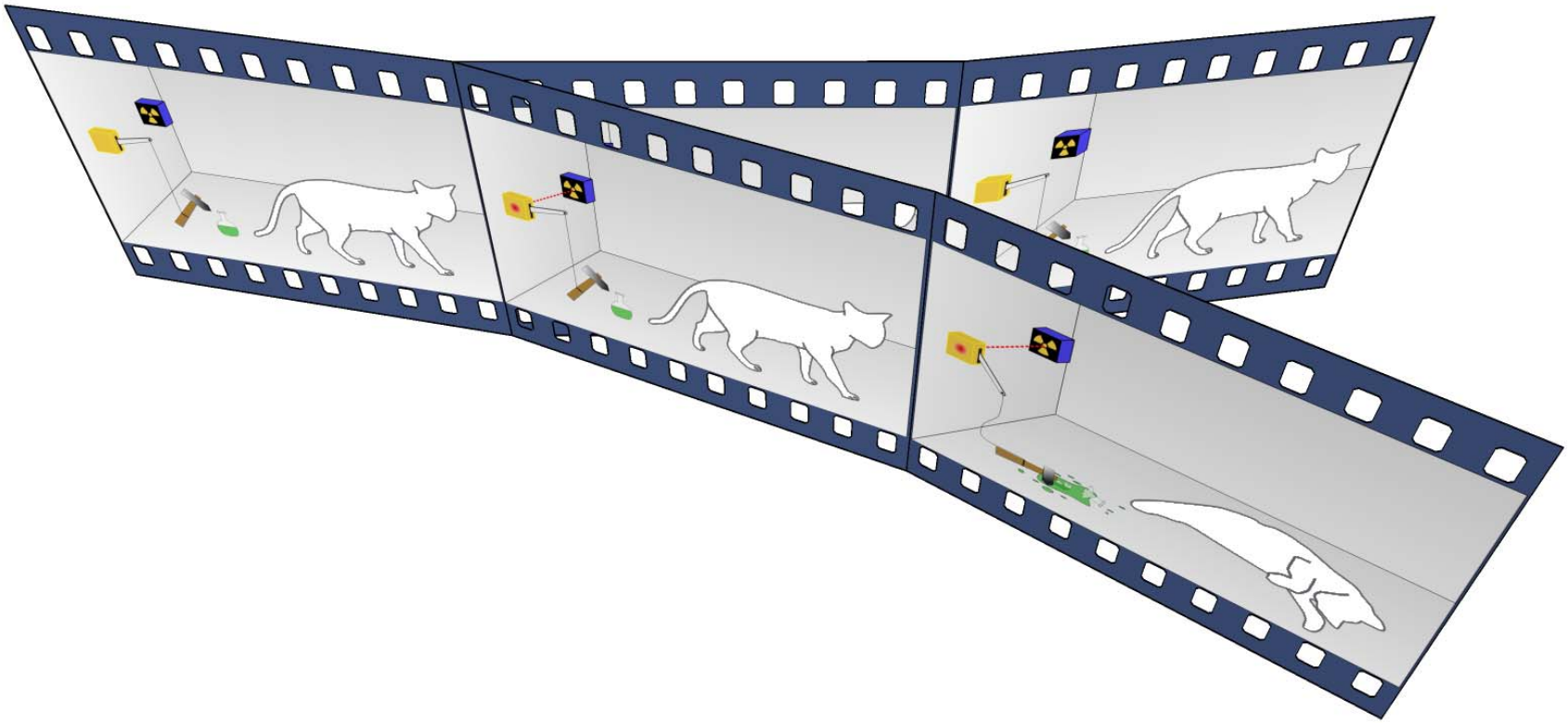
- Propensity score matching: Vocational training of farmers (M 111
- Cost/risk reduction of flood protection (M 126)
- Describing the benefit of rehabilitation of rural roads (M 125)
- Macro impacts by simple Input-output analysis (RDP Slovenia)

The problem:
A perfect control group

Schrödinger‘s cat

or …



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… or

Propensity score matching: Vocational training of farmers (M 111)

CMEF question: *„To what extent have the actions related to training, information and diffusion of knowledge and innovative practises improved the labour productivity and/or other elements related to competitiveness in the agricultural, food and forestry sector?"*

Objective:

- Comparison of two items that are as similar as possible
- One of them has been treated, the other not

Propensity score matching: Vocational training of farmers (M 111)

Approach: *Roy-Rubin* model (Roy 1951; Rubin 1974)

- What is the individual farmer‘s probability of being trained (YES/NO), based on his/her characteristical determinants (predictors such as age, qualification, gender etc.)?
- YES/NO=f (predictor variables)
- Result is the probability of YES and NO for every farmer regardless of being trained or not (the nearest neighbours will be later matched):

Predicted Probability

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Data Editor (Browse) - [predicted probab]

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No[1] 1

	No	Treatment	Age1	Age2	Qualificat~n	treatment_~t
1	1	1	20	20	1	.5222172
2	2	1	23	40	1	.703906
3	3	1	21	20	1	.5222172
4	4	1	24	39	2	.6318429
5	5	0	40	34	1	.6531367
6	6	0	32	39	3	.5629508
7	7	1	29	32	3	.4952957
8	8	0	36	20	4	.3160408
9	9	1	19	21	1	.5319014
10	10	1	20	20	2	.4506469
11	11	1	21	36	4	.4624721
12	12	0	35	23	3	.4089069
13	13	0	32	21	4	.3244984
14	14	0	29	21	3	.390267
15	15	0	31	34	3	.5147173
16	16	1	21	21	2	.4602825
17	17	0	38	18	3	.3629123
18	18	1	24	19	1	.5125162
19	19	1	24	19	2	.4410481
20	20	0	36	19	1	.5125162

Variables

Filter variables here

Variable	Label
No	No.
Treatment	Treatment
Age1	Age 1
Age2	Age 2
Qualification	Qualification
treatment_hat	Pr(Treatment)

Properties

Variables	
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Label	No.
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Value Label	
Notes	
Data	
Filename	predicted probab
Label	

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Propensity score matching: Vocational training of farmers (M 111)

Data requirements:

- Lists of participants/monitoring data: Structure of participants (age, sex, education, professional status, type of farm, size of farm, regional type, income or alternative variable for comparison)
- Official statistics, e.g. anonymised individual data from FADN, to separate participants and non-participants
- Alternative: Surveys among a non-participating panel of farmers or extending monitoring on a pre-defined control group (e.g. a lottery system of project commitments)

Propensity score matching: Vocational training of farmers (M 111)

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Separate presentation:

- Propensity score matching with Stata™ *(Are you interested?)*

Cost/risk reduction of flood protection of the RDP „PAUL“ Rhineland-Palatinate (M 126)

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CMEF question: *„To what extent have supported investments contributed to maintain the economic performance of agricultural holdings through the restoration and/or preservation of the agricultural production potential?”*

Objective: Estimating the cost/risk reduction for agricultural production

Data requirements

- Damage function for agricultural buildings and machinery
- Damage potential along the river (€)
- Damage cost for different crops (€/hectare)
- Level of flood flow determining the specific margin of flooding (and distribution of flooding in the past)

Damage function

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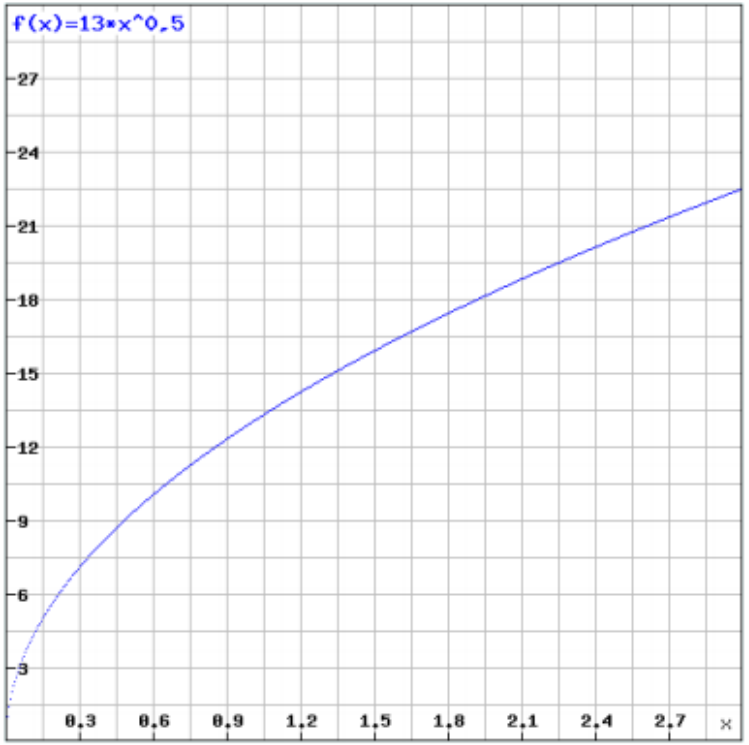
Schaubild 1-5: Schadensfunktion für die landwirtschaftliche Betriebsausrüstung



Ermittelter Zusammenhang: $s(x) = 13\sqrt{x}$

x: m Überflutung

Y: Schadenseffekt %

Risk reduction: from HQ100 to HQ1000 I

$$P_H = 1 - (1 - \frac{1}{T})^n$$

P_H means probability of flooding risk,
T means annuality level (e.g. HQ1000 or HQ100*) and
n means the number of years

*HQ1000: Thousand year flood event (=water gauge exceeded once per 1000 years on average)
HQ100: Hundred year flood event

Risk reduction: from HQ100 to HQ1000 II

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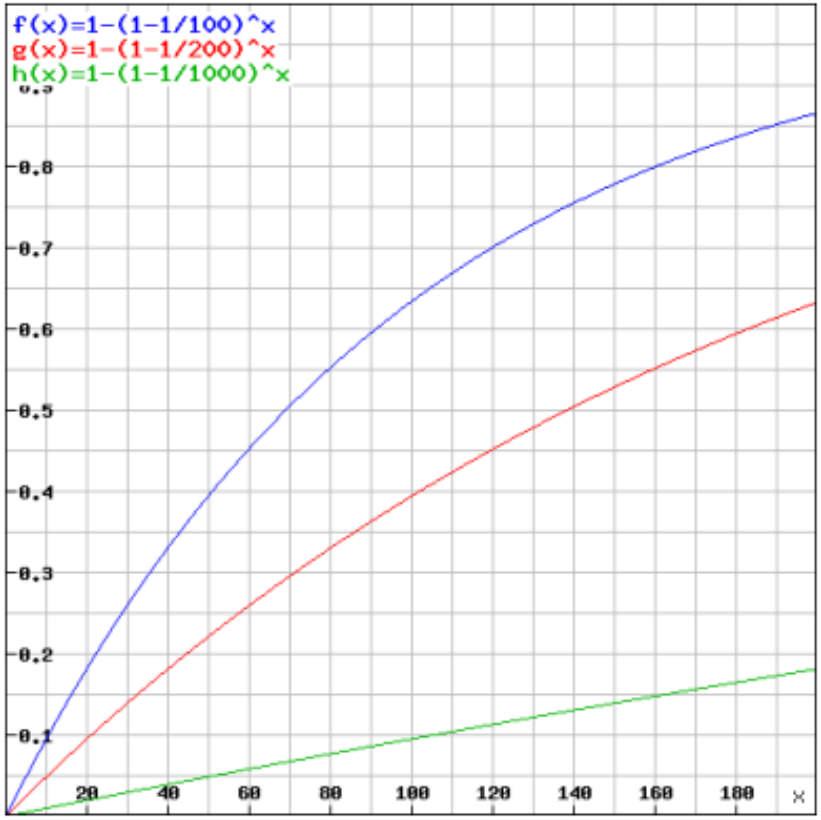
Schaubild 1-6: Vergleich der Risikowahrscheinlichkeiten unterschiedlicher Jährlichkeiten



Quelle: eigene Berechnung

Risk reduction: from HQ100 to HQ1000 III

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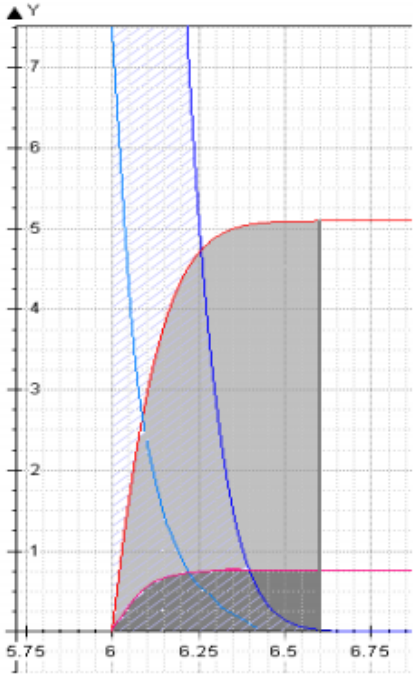
$$SEW_T = S_T \cdot P_T$$

SEW_T means expected value of damage, S_T means value of damage through flooding and P_T means probability of flooding, e.g. with 40% probability (HQ100) and a damage potential of 13.2 billion € along the Upper Rhine, the expected damage value for the next 50 years is at 5.28 billion €, with 5% probability (HQ1000) only 660 million Euro.

Damage risk reduction

$$S_M = \int_{Q_A}^{HHQ} s(Q) \cdot h(Q) \cdot dQ - \int_{Q_A}^{HHQ} s(Q) \cdot h'(Q) \cdot dQ$$

Schaubild 1-7: Schadensminderungsfunktion für die landwirtschaftliche Betriebsausstattung (exemplarisch)



Quelle: eigene Berechnung

Impact of agricultural roads (M 125)

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Related CMEF question: *„To what extent has the scheme promoted the competitiveness of agricultural and forestry holdings through the improvement of infrastructures?"*

Agricultural roads should improve the productivity of the local agriculture. Cost and time savings are at the centre of purpose.

- A suitable evaluation method: Case studies
- Structuring the sample of case studies according to purpose, geography of location, direct and indirect access to plots (e.g. bridge, access roads, supra-municipal connections)

Survey and case studies I

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Data requirements

- Collection of necessary information: justification and need of the agricultural road or its rehabilitation; technical specification
- Aerial image comparison
- Interview with beneficiaries (farmers): How did the new (rehabilitated) road affect the economy of your farm? *(narrative on the transmission mechanisms of policy)*
- Interview with the municipal administration: validating insight

Survey and case studies II

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Evidence suggested by the case studies:

- No representativeness in findings, but …
- Confirmation of intended results
- Insight into the mechanics of impact generation (policy transmission)

Input-Output Analysis: RDP Slovenia

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- Measuring macro impacts based on the present upstream and downstream relationships of the sectors of the Slovene economy

- Data requirements:
  A recent input-output table (Eurostat)
  Expenditure by measure

- Results: demand-induced change of income and/or employment

Input-output analysis I

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EAFRD SLOVENIA: VALUE ADDED MULTIPLIER ANALYSIS 2007-2010

MEASURE 121			Elasticity	Type I Multiplier	resulting value added	Type II multiplyer	resulting value added	Δ value added Type I	Δ value added Type II
Type of cost	Sector	Money paid in €							
MECHANISATION	machinery & equipment	17,208,262.13	1.71	2.12	38,510,462.76	2.15	37,035,464.82	19,302,180.57	19,827,202.69
NEW BUILDINGS	construction work	3,327,817.79	1.61	2.44	8,110,907.06	2.54	8,463,610.37	4,783,089.27	5,135,841.58
ADAPTATION	construction work	8,428,874.88	1.61	2.44	8,352,338.69	2.54	8,716,992.13	4,925,464.67	5,288,717.13
EQUIPMENT	machinery & equipment	2,726,535.02	1.71	2.12	5,785,474.02	2.15	5,868,863.44	3,058,939.00	3,141,334.42
IT EQUIPMENT	office machinery & equipm	8,732.81	18.29	28.77	251,274.27	29.19	254,852.54	242,541.36	246,119.63
NEW PLANTATIONS	construction work	2,060,831.41	1.61	2.44	5,023,094.13	2.54	5,241,354.06	2,962,172.72	3,180,432.64
PERMANNT CROPS	products of agriculture	2,715,287.03	0.39	1.57	4,264,128.69	1.59	4,333,902.59	1,544,841.66	1,614,615.56
PURCHASE OF LAND	Construction work	116,647.77	1.61	2.44	284,306.20	2.54	296,670.39	167,658.43	180,023.22
GENERAL COSTS (documentation...)	other business services	311,242.52	0.19	1.52	474,571.75	1.54	479,597.11	163,329.23	168,354.59
OTHER	other business services	371,378.68	0.19	1.52	566,249.27	1.54	572,240.62	194,886.59	200,882.92
SUM		32,276,000.30			63,622,806.00		71,262,124.63	37,344,803.70	38,984,124.33

MEASURE 122			Elasticity	Type I Multiplier	resulting value added	Type II multiplyer	resulting value added	Δ value added Type I	Δ value added Type II
Type of cost	Sector	Money paid in €							
MACHINERY AND EQUIPMENT	machinery & equipment	11,396,388.10	1.71	2.12	23,966,629.76	2.15	23,995,229.69	12,489,529.66	12,787,127.34
FOREST ROADS AND TRAILS	construction	2,842,300.87	1.61	2.44	6,741,720.31	2.54	6,940,324.03	3,790,223.24	3,988,223.93
GENERAL COSTS (documentation ...)	other business services	13,225.42	0.19	1.52	20,148.66	1.54	20,379.20	6,940.24	7,163.78
OTHER	other business services	9,374.20	0.19	1.52	13,836.02	1.54	13,992.94	4,761.82	4,908.34
SUM		13,963,906.69			28,322,424.26		28,967,612.05	15,256,517.57	15,801,705.36

MEASURE 123			Elasticity	Type I Multiplier	resulting value added	Type II multiplyer	resulting value added	Δ value added Type I	Δ value added Type II
Type of cost	Sector	Money paid in €							
PURCHASE OF PROPERTY	construction work	174,361.55	1.61	2.44	424,972.26	2.54	443,434.81	250,610.73	269,083.28
CRAFTSMEN WORK	construction work	5,120,161.88	1.61	2.44	12,478,886.61	2.54	13,022,138.51	7,358,234.03	7,901,976.73
EQUIPMENT	machinery & equipment	10,807,735.68	1.71	2.12	22,990,567.34	2.15	23,260,310.03	12,122,831.66	12,452,574.41
GENERAL COSTS (documentation ...)	other business services	330,148.43	0.19	1.52	503,398.82	1.54	506,729.44	173,250.39	176,581.01
SUM		16,432,407.24			36,398,824.04		37,232,612.83	19,925,926.81	20,802,225.39

MEASURE 311			Elasticity	Type I Multiplier	resulting value added	Type II multiplyer	resulting value added	Δ value added Type I	Δ value added Type II
Type of Investment	Sector	Money paid in €							
RENEWABLE ENERGY FOR FARM USE	construction work	1,778,188.10	1.61	2.44	4,333,868.81	2.54	4,522,476.69	2,555,788.71	2,744,288.99
RENEWABLE ENERGY FOR SALE	construction work	1,025,451.43	1.61	2.44	2,499,337.06	2.54	2,608,336.30	1,473,886.51	1,582,885.47
SHOP ON FARM	furniture 30%	2,063.00	1.67	2.11	4,363.19	2.15	4,426.48	2,300.19	2,363.48
SHOP ON FARM	machinery & equipment 30%	2,063.00	1.71	2.12	4,377.03	2.15	4,438.97	2,314.03	2,376.97
NON ANNEX I PRODUCTION	construction work?	955,773.13	1.61	2.44	2,330,822.73	2.54	2,428,453.73	1,375,049.34	1,472,680.34
TOURISM	construction work	2,841,638.93	1.61	2.44	6,925,940.88	2.54	7,217,157.70	4,084,301.95	4,375,518.77
SUM		6,608,177.29			16,104,828.87		16,854,993.46	9,496,651.28	10,246,816.17

MEASURE 312			Elasticity	Type I Multiplier	resulting value added	Type II multiplyer	resulting value added	Δ value added Type I	Δ value added Type II
Type of Investment	Sector	Money paid in €							
EQUIPMENT	machinery & equipment	8,487,901.48	1.71	2.12	11,941,828.39	2.15	12,133,840.11	6,323,826.91	6,495,838.63
MACHINERY	machinery & equipment	1,324,438.26	1.71	2.12	2,810,095.48	2.15	2,880,443.93	1,485,657.22	1,526,005.67
TOURISM	construction work	1,721,279.23	1.61	2.44	4,195,202.54	2.54	4,377,740.01	2,474,000.31	2,656,460.78
ANIMAL SHELTER	construction work	200,000.00	1.61	2.44	487,461.01	2.54	508,661.23	287,461.01	308,661.23
ENERGY BIOMASS	machinery & equipment	180,949.34	1.71	2.12	383,918.14	2.15	389,436.97	202,967.13	208,487.83
ENERGY SOLAR	machinery & equipment	1,219,258.72	1.71	2.12	2,586,876.05	2.15	2,624,077.49	1,367,618.33	1,404,818.77
INVESTMENTS IN BUILDINGS	construction work	73,851.89	1.61	2.44	180,243.91	2.54	188,082.29	106,291.42	114,130.40
SUM		10,987,778.82			22,605,645.52		23,072,281.93	12,247,866.30	12,714,503.31

Summary of overall value added effects	Sector	Money paid in €	resulting value added I	resulting value added II	Δ value added Type I	Δ value added Type II
M121, M122, M123, M311, M312	all inputs	78,742,270.14	172,994,038.79	177,241,644.70	94,251,768.65	98,499,374.56

Input-output analysis II

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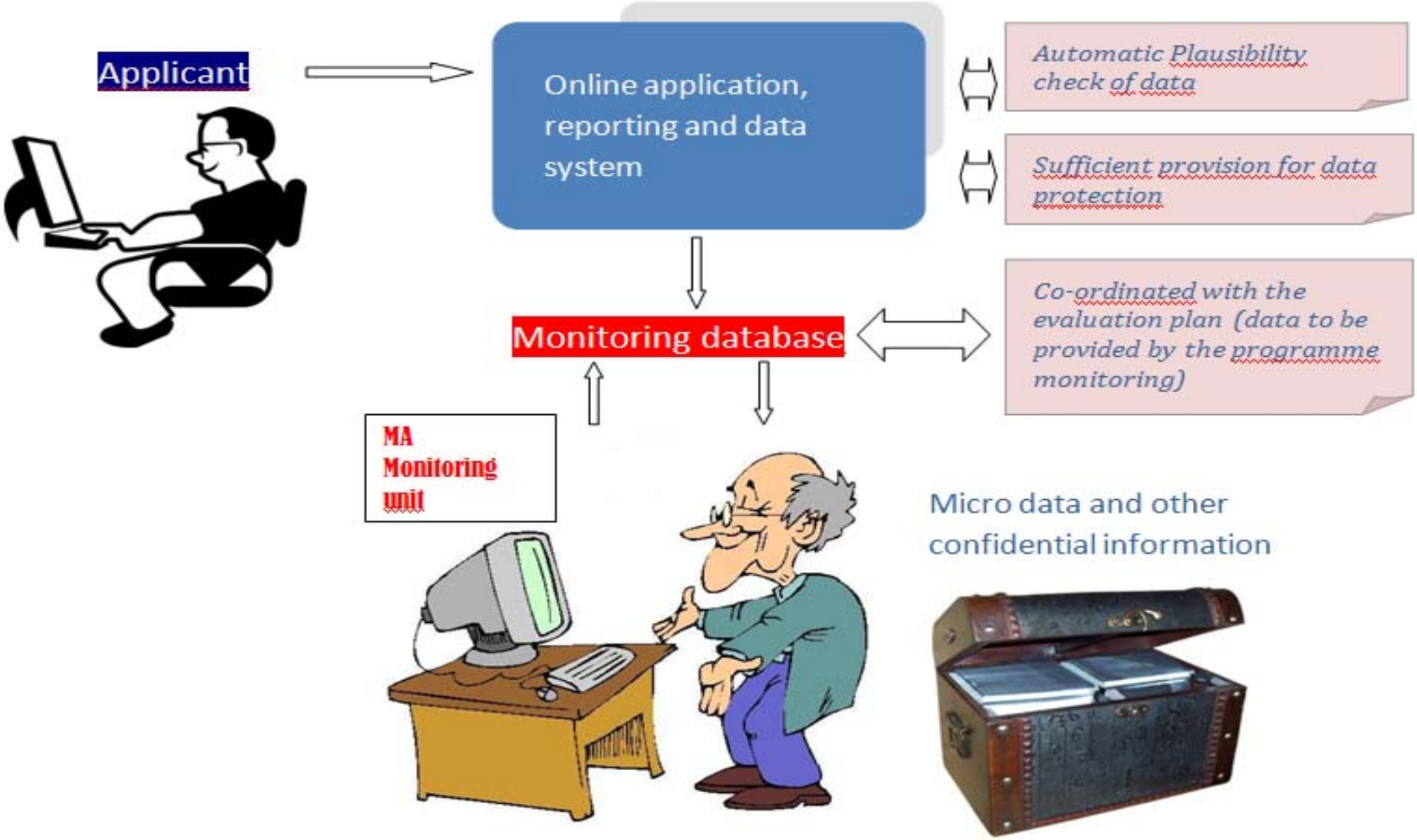
Weaknesses

- The analysis is not thematically specific (e.g. measures) but just focussed on expenditure *(it doesn‘t matter whether the building materials were purchased for agricultural infrastructure or a highway bridge)*
- The results are just showing demand specific changes of the economy, they do not tell anything about improved productivity of capital or whether the farmer has become smarter. This would require a model extension incorporating the supply side with a production function with factor substitution *(costly, technically demanding and more dependent on broad data availability)*
- If input-output analysis is applied at regional level, further effort is needed to estimate the regional coefficients (e.g. by location quotients)

Data management I

- Evaluation effort and costs vary with the ready availability of adequate data
- Monitoring systems should be systematically prepared for later evaluation purposes (reducing evaluation cost and improving evaluation quality)
- Data requirements are to be structured according to the type of intervention and the suggested evaluation method
- The MA should provide access to anonymised micro data (FADN, „integrierte Erwerbsbiographie“ etc.)
- Monitoring should be standardised and linked to the application and reporting systems
- Application forms should include data characterising the applicant
- Application forms should contain a section for forecasting results with and without funding
- Beneficiaries should be asked to report on progress by correcting forecasts

Data management II



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Thank you for your attention!

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