



MIXED
EFFICIENT AND RESILIENT
MIXED FARMING & AGROFORESTRY



MIXED

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| Main authors: | Werner Zollitsch (BOKU), Francesco Accatino (INRAE), Anne Grete Kongsted (AU), Christina Marley (ABER), Guillaume Martin (INRAE), Miranda Meuwissen (WU), Simon Moakes (FIBL), Lisbeth Mogensen (AU), Jaroslaw Stalenga (IUNG-PIP), Kairsty Topp (SRUC), Christine Watson (SRUC) |
| Internal reviewers: | Christine Watson (SRUC), Cláudia Marques dos Santos Cordovil (ISA/ULisboa) |
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Executive Summary

The aim of Task 2.2 was to collect and discuss indicators of resilience and efficiency at the farm level. These indicators were to be compiled in this handbook for use in Task 2.3 and for work in several other work packages.

In an iterative process, a list of indicators and data collection points were defined, which contain basic agronomic and environmental indicators, and indicators developed to measure integration from the point of view of the farming system. Indicators are both qualitative and quantitative and should be interpreted as summary measures which combine different types of information. If data needed for the calculation of indicators will not be available at farm level, complementary data will be taken from data bases.

The indicators and data collection points described herein address soil, crop, livestock, environmental impacts, economics, social aspects, the position of farmers in respective value chains, efficiency and resilience of MIFAS.

Abbreviations

| | |
|-------|--|
| AU | Annual Family workforce Unit |
| AWU | Annual Workforce Unit |
| CDI | Crop Diversity Index |
| D | Deliverable |
| DM | Dry Matter |
| EC | European Commission |
| GDPR | General Data Protection Regulation |
| GE | Gross Energy |
| GIS | Geographic(al) Information System |
| LU | Livestock Unit |
| MIFAS | Mixed Farming and Agroforestry System(s) |
| NE | Net Energy |
| NRE | Non-Renewable Energy |
| UAA | Utilised Agricultural Area |
| WP | Work Package |

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1 Introduction

The aim of Task 2.2 (Work package 2, *Co-design and evaluation of farm systems for efficiency and resilience*) was to collect and discuss indicators of resilience and efficiency at the farm level. The indicators agreed on by the partners involved were to be compiled in this handbook for use in Task 2.3 (mainly 2.3a, *Farm management data collection and collation*) and 2.4 (*Field testing strategies for increased integration*).

After collecting a first list of indicators among the authors, this was discussed and refined in several rounds both inside WP2 and with the leaders and other partners responsible for project activities related to the calculation of indicators in other WPs. In an iterative process, the indicators initially suggested, were prioritized according to

- i) their relevance for efficiency and resilience of MIFAS and
- ii) the needs of project partners.

We additionally tried to include the perspective of network coordinators and farmers about indicators by asking the following questions:

- i) Will data be available for indicator calculation (i.e. will farmers have access to this type of information or will it be possible within the available resources to collect the data in the course of the project)?
- ii) Will network coordinators and/or farmers be interested in the information provided with the assessed indicators?
- iii) What can the network/coordinators/farmers use this type of information for (benchmarking, development of MIFAS, etc.)?

Thereby the list of indicators was finalized to what is presented here. The list of indicators includes basic agronomic and environmental indicators, and indicators developed to measure integration from the point of view of the farming system. Indicators are both qualitative and quantitative and should be interpreted as summary measures which combine different types of information. Not all data needed for the calculation of indicators will be available at farm level and it is accepted it may not be available for all farms. In this case, farm data will be complemented by data available in standard data bases. Information from data bases will be selected by persons who have a sound knowledge of the respective MIFAS or farming system and the regional conditions which will be important in determining the representativity of data taken from data bases.

In the process of identifying indicators, several indicators were suggested which address actors in the value chain other than farmers and their sphere of activity. Some of these indicators are not included in this handbook, for others the information necessary for their calculation may not be available in sufficient quality at the farm level. This has to be taken into account when planning and implementing the actual data collection process.

The selected indicators are presented in Chapter 2 and in sub-chapters which mirror the aspects addressed in a MIFAS context.

2 Suggested indicators for efficiency and resilience

The following sub-chapters contain i) the indicators which are suggested for characterising efficiency and resilience of MIFAS at farm level and ii) the farm data to be collected for the calculation of the indicators. Both data and indicators shall address the MIFAS level; however, in cases where the MIFAS is one component integrated within the overall farm, it may be not meaningful to differentiate between MIFAS and farm level. In such cases, data will be collected at, and indicators will address, the farm level.

It is suggested that the indicators and hence the data they are based on should represent the respective traits over a time period of about 3 years in order to avoid a bias due to, e.g., particularly dry or wet, cold or warm years, etc. In many cases data will not be available for a sequence of several years. In such cases it is suggested that data is collected for a particular year, but the representativity of that collected data for the MIFAS is discussed and confirmed with farmers, network coordinators or scientists familiar with the respective MIFAS or farming system in the region.

The indicators and farm data connected to them will be structured according to the different elements of MIFAS (e.g., soil, crop, livestock, economics, etc.), which will be covered in different sub-chapters.

To allow for a quick and broad overview of the MIFAS (farm) type and as a start on the process of collecting information, the MIFAS (farm) should be first characterised by the following two categories:

- Farm type according to relative share of income from products (in the order from highest to lowest); e.g. dairy – lambs – wheat.
- Proportion of UAA owned vs. rented

2.1 Soil indicators

Table 1 contains a list of suggested indicators for MIFAS-relevant soil characteristics and the data these are based on.

Table 2. Indicators for soil characteristics and soil data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|---------------------------|-------------|---|--|
| 1 | Total nitrogen | mg/kg | N content (DUMAS or Kjeldahl) | |
| 2 | Organic matter content | % | Loss on ignition | Calculated from organic C |
| 3 | Available nitrogen supply | % | Potentially mineralizable N | |
| 4 | Soil texture | categorical | Type of soil (estimated); from FAO soil maps and database | Proportion of sand, silt and clay to be derived by expert depending on soil type |
| 5 | Soil erosion risks | % UAA | Total UAA, ha; fallow soil during winter, ha | |
| 6 | Farm slope angle | degree | Average slope of farmland | |
| 7 | Soil pH | | pH, H ₂ O | If <5, it may be necessary to calculate Al and other metals contents. pH correction to be calculated when applicable |
| 8 | Mn content | mg/kg | Mn content | When pH <5 |

2.2 Crop indicators

Table 2 contains a list of suggested indicators for MIFAS-relevant crop (including grassland) characteristics and the data these are based on.

Table 2. Indicators for characteristics and data needed from crop production at crop (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|-------------------------|--------------------|---|---|
| 1 | Nutrient recommendation | kg/ha per nutrient | Total nutrition needs for the crop, according to local standard recommendations available | Per crop type |
| 2 | Mineral N input | kg/ha | Total UAA and by crop, ha; kg mineral N applied & type of fertilizer | # = to be collected for each type of crop |
| 3 | Organic N input | kg/ha | Total UAA and by crop, ha; tonnes or m ³ of slurry/manure | # = to be collected for each type of crop; separately for on farm and imported organic N input; kg organic N applied calculated from collected data |
| 4 | Total N input | kg/ha | none; sum of above | |
| 5 | Mineral P input | kg/ha | Total UAA and by crop, ha; kg mineral P applied & type of fertilizer | # = to be collected for each type of crop |
| 6 | Organic P input | kg/ha | Total UAA and by crop, ha; tonnes or m ³ of slurry/manure | # = to be collected for each type of crop; separately for on farm and imported organic P input; kg organic P applied calculated from collected data |
| 7 | Total P input | kg/ha | none; sum of above | |
| 8 | Mineral K input | kg/ha | Total UAA, ha; kg mineral K applied & type of fertilizer | # = to be collected for each type of crop |
| 9 | Organic K input | kg/ha | Total UAA, ha; tonnes or m ³ of slurry/manure | # = to be collected for each type of crop; separately for on farm and imported organic K input; kg organic K applied calculated from collected data |
| 10 | Total K input | kg/ha | none; sum of above | |
| 11 | Agrochemical use | kg per year | Type (active ingredient rather than product name) and quantity used | Specify per pesticide, fungicide, etc. if feasible |
| 12 | Irrigation | yes / no | If yes, quantity used per year | |
| 13 | Irrigation type | categorical | Type of irrigation device used | Drip, sprinkler, pivot, etc |
| 14 | Output crop # | kg DM/ha | UAA cultivated with crop #, ha; crop yield, kg | # = to be collected for each type of crop |

Table 2 (contd.). Indicators for characteristics and data needed from crop production at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|--|-------------------------|--|--|
| 15 | Output by-product A | kg DM/ha | UAA cultivated with crop #, ha; yield of by-product A, kg | # = to be collected for each type of crop; by-product including cultural residues |
| 16 | N-output crop # | kg N/ha | None (yield from above; N-content to be taken from database) | to be repeated for P-, K- and energy-outputs |
| 17 | N-output by-product A | kg N/ha | None (yield from above; N-content to be taken from database) | to be repeated for P-, K- and energy-outputs |
| 18 | N-output by-product B | kg N/ha | None (yield from above; N-content to be taken from database) | to be repeated for P-, K- and energy-outputs |
| 19 | Total output crop (by-product) # to livestock | kg DM/LU | yield crop (by-product) # to which type of livestock; LU | |
| 20 | Total N-output crop (by-product) # to livestock | kg N/LU | yield & N-content crop (by-product) # to which type of livestock; LU | N-content taken from database; to be repeated for P-, K- and energy-outputs |
| 21 | N-balance of crop production | t/ha | calculated from above (N applied, t; N harvested, t; UAA for crop production, ha) | |
| 22 | Share of land with legume crops and mixtures containing legume crops | ha/ha | Total UAA and by crop, ha; UAA with legumes, ha; in case of mixtures with legumes: proportion of legumes in plant communities (from 0 to 1) | % legumes within e.g. extensive, intensive permanent grassland or temporary grasslands |
| 23 | Share of land with permanent grassland | ha/ha | Total UAA, ha; UAA with permanent grassland, ha; intensity of land use (1=low, 2=moderate, 3=high intensity; grazing intensity included) | Permanent grassland is grassland persisting for more than 5 years |
| 24 | Number of harvests | n/year | Number of cuts | Per type of grassland (as above) |
| 26 | Use of stubble | ha | Stubble grazing Y/N, duration and intensity of grazing | When applicable estimate N exported <i>versus</i> N left |
| 27 | Share of land with non-permanent meadows | ha/ha | Total UAA, ha; UAA with non-permanent meadows, ha; intensity of land use (1=low, 2=moderate, 3=high intensity; grazing intensity included) | |
| 28 | Number of harvests | n/year | Number of cuts | |
| 29 | Crop Management | qualitative description | Description of soil cultivation & crop management processes (e.g., ploughing, no tillage, fertiliser application, intercropping, use of cover crops, etc.) | Description shall allow to avoid questions on fuel (diesel) usage etc.; to be specified for most important crops. Differentiation into different process steps may be necessary. |

Table 2 (contd.). Indicators for characteristics and data needed from crop production at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|--|----------------|--|---|
| 30 | Soil Organic Matter Balance | t/ha | UAA cultivated with all crops, ha; manure and slurry application | Need to know if straw is removed, or e.g. deliberate low stocking rate of grassland (residue forming) |
| 31 | Crop Diversity Index | 0-1 | UAA cultivated with all crops; $CDI = \sum Pi^2$; where, $Pi = UAA$ of particular crop/ total UAA (in ha) | |
| 32 | Productive trees per ha | number | Number of fruit/nut trees per ha of crop or grassland (differentiate) | |
| 33 | Average biomass/size of an average tree | m ³ | Average biomass/size of an average tree; or: type, estimated diameter and height of tree | |
| 34 | Years of growth/tree and replacement age | years | Years of growth/tree and replacement age | |
| 35 | Yield of trees | t/ha | Yield of different tree types (primary fruit/nuts, secondary - wood?) | |
| 36 | Further additional (marginal) products | kg | e.g. cork, mushrooms, acorns, asparagus, etc. | If applicable and if products are sold or processed |
| 37 | Specific ecosystem services | categorical | Tourism or any other (immaterial) services | If applicable |

2.3 Livestock indicators

Table 3 contains a list of suggested indicators for MIFAS-relevant characteristics of livestock production and the data these are based on.

Table 3. Indicators for characteristics and data needed from livestock production at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|--|--------------------|--|---|
| 1 | Output livestock category # | kg, litres | Number of livestock #, n and LU; yield of product (milk, eggs, age and live weight or growth rate of animals intended for slaughter, or sold for breeding or other purposes, wool, etc.) | # = to be collected for each livestock category and type of product |
| 2 | N-, P-, K-output livestock category # | kg N, P, K | Number of livestock #, n and LU; yield & N-, P-, K-content of product (to be collected for all products; non-primary products eventually from data bases) | # = to be collected for each livestock category and type of product; similar for energy-outputs |
| 3 | Compound feed imported | t | Amount and composition of compound feed imported; content of DM; N, P, K from data bases | |
| 4 | Compound feed produced on farm | t | quantity collected under "crops"; DM-, N-, P-, K-content | |
| 5 | Forage imported | t | Amount and composition of forage imported; content of DM, N, P, K | |
| 6 | Forage produced on farm | t | quantity collected under "crops"; DM-, N-, P-, K-content | Can also be estimated from livestock numbers and production as a cross-check |
| 7 | Feed self-sufficiency (DM) | t/t | Amount of feed grown on farm, t DM; amount of feed required, t DM; calculated from other data | |
| 8 | Feed self-sufficiency (N) | t/t | Amount of N in feed grown on farm, t DM; amount of N in feed required, t DM; calculated from other data | |
| 9 | Share of feed coming from permanent grassland (DM basis) | t/t | Amount of feed from permanent grassland, t DM; total amount of feed input into livestock, t DM; calculated from other data | |
| 10 | Land available to livestock per livestock unit | ha/LU | Total UAA for livestock (including feed production), ha; number of livestock #, n and LU | |
| 11 | Breed type | categorical | Specialised, dual purpose? | |
| 12 | Longevity & Replacement rates (and mortality) | years or cycles; % | Duration of time or production cycles which animals typically spend in the herd (flock); proportion of animals replaced per year | |

Table 3 (contd.). Indicators for characteristics and data needed from livestock production at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|------------------------------------|---------------------|---|----------|
| 13 | Purchased livestock | number, age, weight | Type, number, age, weight of purchased animals | |
| 14 | Share of forages in livestock diet | t/t | Amount of forages for livestock, t DM; total amount of feed input into livestock, t DM; calculated from other data | |
| 15 | Outdoor access for animals | days/year | Number of animals per pen (housing unit) and area of land available per pen (housing unit); type of outdoor area (floor type, pasture or other land type) | |
| 16 | Husbandry system | categorical | Flooring (proportion of slatted and solid floor), lying area (slatted, solid, rubber mats, litter material) | |
| 17 | Manure management (i) | categorical | Type of manure (slurry vs. solid dung); cleaning frequency; manure storage (open or covered slurry tank, manure heap); composting of manure (yes/no); duration of storage; method of application of slurry (manure) | |
| 18 | Manure management (ii) | categorical | Ratio of slurry to solid manure | |
| 19 | Manure management (iii) | t | Type and quantity of bedding material per animal class | |
| 20 | Manure management (iv) | months | Duration of slurry/solid manure storage | |
| 21 | Manure management (v) | categorical | Slurry tank management (stirred, covered) | |
| 22 | Manure management (vi) | % | % of manure exported | |

2.4 Environmental impact indicators

Table 4 contains a list of suggested indicators for environmental impacts of MIFAS and the data these are based on.

Table 4. Indicators for environmental impacts and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|--|-------|--|--|
| 1 | N- balance total farm, herd and field level | kg/ha | N input, t; N output, t; UAA, ha; herd size; calculated from data collected in 2.2 (Crop indicators) and 2.3 (Livestock indicators) | |
| 2 | P- balance total farm, herd and field level | kg/ha | P input, t; P output, t; UAA, ha; herd size; calculated from data collected in 2.2 (Crop indicators) and 2.3 (Livestock indicators) | |
| 3 | K- balance total farm, herd and field level | kg/ha | K input, t; K output, t; UAA, ha; herd size; calculated from data collected in 2.2 (Crop indicators) and 2.3 (Livestock indicators) | |
| 4 | CH ₄ emissions from enteric fermentation per livestock unit | t/LU | Diet composition (sufficient for estimation of GE-intake; on annual basis); (number of LU collected under "livestock") | Digestibility of diet to be calculated from database if needed for Tier 2 approach |
| 5 | CH ₄ emissions from enteric fermentation per N output unit of livestock | t/t | none (calculated from enteric CH ₄ above & N-output from livestock indicators) | |
| 6 | CH ₄ emissions from manure management per livestock unit | t/LU | type of manure system; length of storage (months), diet composition for the period of housing (sufficient for estimation of organic matter digestibility or NE/GE and volatile solids); (number of LU collected under "livestock") | |
| 7 | CH ₄ emissions from manure management per N output unit of livestock | t/t | none (calculated from CH ₄ from manure management above & N-output from livestock indicators) | |
| 8 | N ₂ O emissions per livestock unit | t/LU | Diet composition (sufficient for estimation of N-intake vs. N in products); (number of LU collected under "livestock") | N-digestibility to be calculated from database for estimation of N-excretion |

Table 4 (contd.). Indicators for environmental impacts and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|---|--------------------------------|--|--|
| 9 | N ₂ O emissions per N output unit of livestock | t/t | none (calculated from other data) | specified N ₂ O output per unit of crop production will be calculated from collected data |
| 10 | NH ₃ emissions per livestock unit | t/LU | none; (manure system and diet composition from above; Tier 2 EMEP-guidelines; number of LU collected under "livestock") | |
| 11 | NH ₃ emissions per N output unit of livestock | t/t | none (calculated from other data) | |
| 12 | Share of area in Natura 2000 network | ha/ha | Natura 2000 area, ha; (UAA, ha collected under "crop indicators") | |
| 13 | Share of area of natural habitat | m ² /m ² | Can be collected via GIS data from Google Earth; show farmer Google Earth image and ask him/her to indicate maintained natural habitat | |
| 14 | Share of area under agro-environmental measures | m ² /m ² | UAA, ha (collected under "crop indicators"); area under agro-environmental measures (if known); Otherwise, this can be collected via GIS data from Google Earth; show farmer Google Earth image and ask him/her to indicate area under agro-environmental measures | |
| 15 | Length of hedges per area | m/m ² | Can be collected via GIS data from Google Earth; show farmer Google Earth image and ask him/her to indicate hedges | Including type of plants forming hedges |
| 16 | Number of isolated trees per surface unit | n/m ² | Can be collected via GIS data from Google Earth; show farmer Google Earth image and ask him/her to indicate isolated trees | Including those recently planted |
| 17 | Riparian strips per surface unit | m/m ² | Can be collected via GIS data from Google Earth; show farmer Google Earth image and ask him/her to indicate riparian strips | |

2.5 Economic indicators

Table 5 contains a list of suggested indicators for economic performance of MIFAS and the data these are based on.

Table 5. Indicators for economic performance and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|---|------------|--|--|
| 1 | Revenue from outputs per expenses for inputs | €/€ | Total revenue for outputs, €, total expenses for inputs, €, differentiated by crop and livestock | |
| 2 | Gross income per workforce unit | €/AWU | Gross income, €, labour, AWU | AWU = annual workforce unit |
| 3 | Subsidies fraction in total revenue | €/€ | Subsidies, €, total revenue, € | |
| 4 | Net income per workforce unit | €/AWU | Net income, €, labour, AWU | AWU = annual workforce unit |
| 5 | Revenue per total asset unit | €/€ | Optional: Total revenue for outputs, €, total assets, € | If this information appears to be too personal, use estimates from FADN data |
| 6 | Share of net worth in the total asset | €/€ | Optional: Net worth, €, total assets, € | If this information appears to be too personal, use estimates from FADN data |
| 7 | Cash flow I per family workforce unit | €/AFU | Family labour, AFU; Optional: Cash flow, € | AFU = annual family workforce unit; If information on cash flow appears to be too personal, use estimates from FADN data |
| 8 | Gross margin per ha (arable) or per LU, head or forage ha (livestock) | €/ha; €/LU | none; (calculated from total revenues & total expenses above; UAA collected under "crops"; LU collected under "livestock") | The income/costs need to be differentiated at the crop/livestock enterprise level to calculate the enterprise GMs. |

2.6 Social indicators

Table 6 contains a list of suggested social indicators for MIFAS and the data these are based on.

Table 6. Indicators for social aspects and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|---|---------------------|--|--|
| 1 | UAA per workforce unit | ha/AWU | None; calculated from other data; UAA collected under 2.2, Crop indicators; AWU collected under 2.5, Economic indicators | All family labour (e.g. spouse and children) shall be included here. |
| 2 | Livestock units per workforce unit | LU/AWU | None; calculated from other data; LU collected under 2.3, Livestock indicators; AWU collected under 2.5, Economic indicators | |
| 3 | Hired workforce per total workforce | hired AWU/total AWU | None; calculated from other data; AWU and AFU collected under 2.5, Economic indicators; Hired AWU = AWU - AFU | |
| 4 | Number of hours compared to statutory time as perceived by the farmer | categorical | Stated as full time, part time, or as a percentage of FT e.g. 100%. | |
| 5 | Free time | h/week | Number of hours of free time per week | |
| 6 | Number of weekends off in a year | n/year | Number of work-free weekends per year | |
| 7 | Number of days off for holiday in a year | n/year | Number of free days (for vacation) per year | |
| 8 | Workload of the farm as perceived by the farmer | Likert scale, 1-5 | Perceived workload, 1= very low, 5 = extremely high | |
| 9 | Exposure to hazardous chemicals | Likert scale, 1-5 | Perceived exposure, 1= very low, 5 = extremely high | |
| 10 | Concern about physical work | Likert scale, 1-5 | Concern, 1= very low, 5 = extremely high | |
| 11 | Education indicator | h/year | Time spent in training per year | Asking this would need to be justified due to GDPR! This might be avoided by asking for number of trainings attended per year. |
| 12 | Employment | n | Number of permanent and seasonal jobs created on farm due to MIFAS | |

Table 6 (contd.). Indicators for social aspects and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|---|---------------------------|--|----------|
| 13 | Working atmosphere | Likert scale, 1-5 | Perceived atmosphere, 1= very poor, 5 = extremely good | |
| 14 | Income as perceived by the farmer | Likert scale, 1-5 | Perceived income, 1= very poor, 5 = extremely high | |
| 15 | Farm performance as perceived by the farmer | Likert scale, 1-5 | Perceived performance, 1= very poor, 5 = extremely high | |
| 16 | Collaboration indicator: meetings | h/year | Time spent in collaboration meetings | |
| 17 | Collaboration indicator: assistance (active) | h/year | Time spent in helping others | |
| 18 | Collaboration indicator: assistance (receiving) | h/year | Time others help you | |
| 19 | Collaboration indicator: administration | h/year | Time spent in collaboration administration | |
| 20 | Economic viability in 10 years as perceived by the farmer | yes/no | Expectation whether farm will or will not be economically viable in 10 years | |
| 21 | Expectation about farm succession | categorical | | |
| 22 | Overall farmer's satisfaction | Likert scale, 1-5 | Overall satisfaction with current situation and situation in the near future, 1= very poor, 5 = extremely positive | |
| 23 | Income of spouse | % spouse working off farm | Proportion of spouse working off farm in % of a total workforce | |

2.7 Indicators for position of farmers in value chain

Table 7 contains a list of suggested indicators which characterise the position of farmers in the value chain(s) and the data these are based on.

Table 7. Indicators for farm position in value chain and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|--|--------------------|---|---|
| 1 | Power and Dependency Dyadic Relationship, by each farmer per buyer | Two* Likert scales | perceived buyer dependency, 1 = low, 5 = high; perceived supplier dependency, 1 = low, 5 = high | Each farmer gives their perception of their relations with each of their buyers for their products. Different dependencies determine strengths of negotiation positions, and hence captured value, of specific actors |
| 2 | Number of actors main product(s) is (are) sold to | n | Number of buyers (actors) the main product(s) is (are) being sold to | Number of buyers separately if several products are sold |
| 3 | Type of buyer for main product(s) | categorical | Type of buyer (actor) main product(s) is (are) being sold to | |
| 4 | Number of actors by-product(s) is (are) given away to | N | Number of actors the by-product(s) is (are) given away to | Number of buyers separately if several by-products |
| 5 | Type of actor for by-product(s) | categorical | Type of actor by-product(s) is (are) give away to | |
| 6 | Type of sale channel for main product(s) | categorical | Type of sale channel for main product(s) going to main actor(s) (buyer(s)) | |
| 7 | On-Farm processing for main primary product(s) | yes/no | Is (are) saleable primary product(s) being processed into saleable product(s)? | |
| 8 | Value added by processing (only if processing takes place on farm) | €/unit (e.g. kg) | Value of saleable processed product - value of saleable primary product | |
| 9 | Perception of value-added processing | Likert scale | Do farmers feel that processing improves products' marketability with buyers? | |
| 10 | Number of partnerships | N | Number of other non-buyer actors involved in production, processing or marketing (e.g. cooperatives, inter-farmer relations such as input exchange, etc.) | Should be answered for each type of partnership defined by a transaction of a specific matter or land |
| 11 | Type of partner | categorical | Type of partners involved in partnership from above | |

Table 7 (contd.). Indicators for farm position in value chain and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|--|-------------|---|--|
| 12 | Importance of the partnership for the farmer regarding substitutability | categorical | Subjective view of the farmer regarding the impact of the substitutability of the partnership from above (1=very substitutable; 4=very difficult to substitute) | What if the partnership stops, how much is it going to change/impact your farming practices/ organization? |
| 14 | At farm level: Extra costs due to MiFAS (compared to specialised system) | €/unit | Extra costs (fixed, variable) & risks (productions,) due to being a MIFAS compared to a specialised farm | If numbers are not possible, qualitative answers also suffice |
| 15 | At farm level: Reduced costs due to MiFAS (compared to specialised system) | €/unit | Reduced costs (fixed, variable) & risks (production, financial,) due to being a MIFAS compared to a specialised farm | If numbers are not possible, qualitative answers also suffice |
| 16 | At farm level: Additional revenues due to MiFAS (compared to specialised system) | €/unit | Additional revenues, such as price premium, due to being a MIFAS compared to a specialised farm | If numbers are not possible, qualitative answers also suffice |
| 17 | At farm level: Revenues forgone due to MiFAS (compared to specialised system) | €/unit | Revenues forgone, such as missing a volume bonus, due to being a MIFAS compared to a specialised farm | If numbers are not possible, qualitative answers also suffice |

2.8 Efficiency indicators

Table 8 contains a list of suggested indicators for efficiency of MIFAS and the data these are based on.

Table 8. Efficiency indicators and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|--|--------------------|---|----------|
| 1 | DM-output crops per UAA | kg/ha | None; calculated from other data; UAA collected under 2.2, Crop indicators; AWU collected under 2.5, Economic indicators | |
| 2 | DM-output crops per workforce unit | kg/AWU | None; calculated from other data; crop output collected under 2.2, Crop indicators; AWU collected under 2.5, Economic indicators | |
| 3 | N-output crops per UAA | kg/ha | None; calculated from other data collected under 2.2, Crop indicators | |
| 4 | N-output crops per workforce unit | kg/AWU | None; calculated from other data collected under 2.2, Crop indicators and 2.5, Economic indicators | |
| 5 | N-output livestock per LU | kg N/n | None; calculated from other data collected under 2.3, Livestock indicators | |
| 6 | Total farm N-output per workforce unit | kg N/AWU | None; calculated from other data collected under 2.2, Crop indicators, 2.3, Livestock indicators and 2.5, Economic indicators | |
| 7 | N-output crops to livestock per workforce unit | kg N/AWU | None; calculated from other data collected under 2.2, Crop indicators, 2.3, Livestock indicators and 2.5, Economic indicators | |
| 8 | N-efficiency total farm | kg/kg | None; calculated from other data collected under 2.2, Crop indicators, and 2.3, Livestock indicators | |
| 9 | N-efficiency of plant production | kg/kg | None; calculated from other data collected under 2.2, Crop indicators | |
| 10 | N-efficiency of livestock production | kg/kg | None; calculated from other data collected under 2.3, Livestock indicators | |
| 11 | Thrifty use of non-renewable energy (NRE) | MJ/€ gross product | None; calculated from other data collected under 2.2, Crop indicators (management processes) and taken from data bases; data collected under 2.4, Environmental impact indicators, and 2.5, Economic indicators | |

Table 8 (contd.). Efficiency indicators and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected | Comments |
|-----|-------------------------------------|---------------------------------|---|--|
| 12 | Productivity of NRE inputs | MJ from outputs / MJ NRE inputs | None; calculated from other data collected under 2.2, Crop indicators (management processes) and taken from data bases; data collected under 2.4, Environmental impact indicators, and 2.5, Economic indicators | |
| 13 | Economic efficiency (profitability) | € outputs / € inputs | None; calculated from other data collected under 2.2, Crop indicators, 2.3, Livestock indicators, and 2.5, Economic indicators | |
| 14 | Total factor productivity | €/€ | None; calculated from other data collected under 2.2, Crop indicators, 2.3, Livestock indicators, and 2.5, Economic indicators | |
| 15 | Technical efficiency | dimension-less | None; calculated from other data collected under 2.2, Crop indicators, and 2.3, Livestock indicators | From collected data production function will be computed, comparing actual and maximum production, actual and minimum input use. |
| 16 | Economic efficiency | dimension-less | None; calculated from other data collected under 2.2, Crop indicators, 2.3, Livestock indicators, and 2.5, Economic indicators | From collected data production function will be computed, comparing actual and maximum revenues, actual and minimum costs. |

2.9 Resilience indicators

Table 9 contains a list of suggested indicators for resilience of MIFAS and the data these are based on.

Table 9. Resilience indicators and data needed at farm (MIFAS) level

| No. | Indicator | Unit | Data to be collected ¹ | Comments |
|-----|----------------------|---------------------------------------|---|----------|
| 1 | Robustness (1) | Scale 1 - 7 & "Why so?" ² | Perceived capacity of farm to return to current profitability after serious challenges | |
| 2 | Robustness (2) | Scale 1 - 7 & " Why so?" ² | Perceived personal capacity of managing the farm to allow quick recovery from shocks | |
| 3 | Robustness (3) | Scale 1 - 7 & " Why so?" ² | Perceived easiness to personally get back to normal after a setback | |
| 4 | Robustness (4) | Scale 1 - 7 & " Why so?" ² | Perceived sufficiency of options to deal with severe shocks on the farm | |
| 5 | Adaptability (1) | Scale 1 - 7 & " Why so?" ² | Perceived capacity of farm to adopt new activities, varieties, technologies in response to challenges | |
| 6 | Adaptability (2) | Scale 1 - 7 & " Why so?" ² | Perceived personal capacity of adaptation to challenging situations | |
| 7 | Adaptability (3) | Scale 1 - 7 & " Why so?" ² | Perceived ability to personally adapt in times of change | |
| 8 | Adaptability (4) | Scale 1 - 7 & " Why so?" ² | Perceived inflexibility of farm, i.e., lack of adjustment if dealing with a changing environment | |
| 9 | Transformability (1) | Scale 1 - 7 & " Why so?" ² | Perceived personal ability to make decisions that result in transformation | |
| 10 | Transformability (2) | Scale 1 - 7 & " Why so?" ² | Perceived difficulty of farm reorganisation in response to drastical change of external circumstances | |
| 11 | Transformability (3) | Scale 1 - 7 & " Why so?" ² | Perceived ability to drastically reorganise the farm in reaction to challenges | |
| 12 | Transformability (4) | Scale 1 - 7 & " Why so?" ² | Perceived ability to make major transformative changes if needed | |

¹Based on: Slijper, T., Y. de Mey, P.M. Poortvliet, M.P.M. Meuwissen, 2020. From risk behaviour to perceived farm resilience: a Dutch case study. *Ecology and Society* 25(4):10.

²Open question.

3 Implementation & outlook

The selected data collection points and wide-ranging indicators presented in chapter 2 provide a basis for development of a data collection and reporting process, continued in Task 2.3, and linked to work in many other work packages. During this process, further refinement of the exact data requirements and style of data collection will be undertaken to enable the optimal combination of simplicity of use, whilst ensuring the highest data quality for use within the project.

Note that each MIFAS has its own specificities and that additional indicators may be necessary.