1.2 INDICATOR FRAMEWORK FOR MEASURING THE IMPACT OF POLICIES/GLOBAL DRIVERS ON IDM UNITS IN AGRICULTURE

This deliverable presents the indicator framework developed in MIND STEP for estimating the impact of selected agricultural policy questions (hereafter referred to as scenario groups) and/or global drivers on Individual Decision Making farm units. First, we review relevant indicator datasets, and select indicators meaningful to answer the policy questions described in MIND STEP Deliverable 1.1. We structure this draft list around relevant themes covering both the economic, environmental and social dimensions of sustainability, and the selected MIND STEP scenario groups, namely Climate change action, Preserve biodiversity, ecosystem services and environmental care and Competitiveness in the agricultural sector. We considered a larger number of themes linked to the environmental impacts, following the conclusions of the first stakeholder workshop. This is an important feature of the MIND STEP framework. Second, we validate the draft list with the MIND STEP core group of stakeholders, via a questionnaire and an online (second) stakeholder workshop, where we discuss the list and the results of the questionnaire. The stakeholders were asked to choose the 10 indicators that they considered more meaningful to describe the impacts in each of the three scenario groups. The more chosen indicators are listed in the table 1 below, with the number of selected times between brackets. The indicator names are marked in colours according to the impact dimension (orange is economic, green is environmental and blue is social) to show the distribution among the three dimensions per scenario group. Third, we do a systematic literature review, using the Web of Science and Scopus, targeted to identify additional indicators, relevant at the farm level, cited (in research or practice) to assess agricultural policy impacts. Finally, we present the consolidated MIND STEP indicator framework, resulting from the stakeholder feedback and the literature review. The consolidated MIND STEP indicator list can be found in table 2. From the second MIND STEP stakeholder workshop it was concluded that the framework is a stimulating platform for discussions about the potential impacts of the new CAP.

Table 1. Top ten relevant indicators per scenario group according to the stakeholder

Scenario groups	Relevant
Climate change action	- Greenhouse gas emissions from agriculture (7) - Land use change (5) - Carbon price (5) - Share of agricultural land under commitments to improve climate adaptation (4) - Carbon demand (4) - Energy used in agriculture, forestry and food industry (3) - Production of renewable energy from agriculture and forestry (3) - Share of agricultural land under commitments to reducing emissions, maintaining and/or enhancing carbon storage (permanent grassland, agricultural land in peatland, forest, etc.) (3) - Share of farms benefitting from CAP investment support contributing to climate change, mitigation and adaptation, and to renewable energy or biomaterials production (3) - Soil organic carbon in agricultural land (3)
Preserve biodiversity, ecosystem services and environmental care	- Gross nutrient balance – nitrogen (3) - Share of livestock units under supported commitments to improve environmental sustainability (3)

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	- Nitrogen from fertilisers (3) - High Nature Value farmland (3) - Farmland birds index (3) - Percentage of species and habitats of Community interest related to agriculture with stable or increasing trends (3) - Land cover (2) - Agri-environmental commitments (2) - Farming intensity (2) - Share of agricultural land under management commitments for water quality (2) - Nitrates in ground water (2) - Share of agricultural land under management commitments beneficial for soil management (2) - Agricultural land covered with landscape features (2) - Area supported for afforestation and creation of woodland, including agroforestry (2)
Competitiveness in the agricultural sector	- Total factor productivity in agriculture (6) - Farm income by type of farming (5) - Farm income by region (5) - Crop yield (3) - Age structure of farm managers (3) - Share of farmers receiving investment support to restructure and modernise, including to improve resource efficiency (3) - Labour productivity in agriculture (3) - Real export price (3)

Table 2 Consolidated MIND STEP indicator list. The indicators are grouped by sustainability IMPACTS and THEMES. The indicators marked in black belong to the lists of the Common Agricultural Policy and Agri-environmental indicators (EUROSTAT), those marked in red are indicators available from the MIND STEP models, and in blue are the indicators reported in the papers selected in the literature review

Impacts	INDICATOR THEMES	ID	INDICATOR NAME
Economic			
	Agricultural productivity	1	Total factor productivity in agriculture/ Production Value (of the whole farm or different production lines)
		2	Crop yield
		3	Crop yield - rainfed
		4	Crop yield - irrigated
		5	Climate change shifter on crop yield
		6	Livestock yield (endogenous)
		7	Labour productivity in agriculture
		8	Labour productivity in forestry
		9	Labour productivity in food industry
		10	Capital productivity
	Farm income/GDP	11	Farm income by type of farming
		12	Farm income by region
		13	Specialisation/diversification
		14	Income per annual working unit (AWU)

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Impacts	INDICATOR THEMES	ID	INDICATOR NAME
		15	Total gross margin
		16	Cash flow (income minus depreciation)
		17	Change of the owner's capital (based on withdrawals and contributed capital)
		18	GDP per capita in PPS in rural areas as a percent of other areas and EU average
		19	GDP by farm size
		20	Contribution of farm/agriculture to GDP
		21	Profitability of land
		22	Profitability of labour
		23	Profitability of capital (remuneration of used production factors <> opportunity costs)
		24	Profit rate (income in relation to operation income)
		25	Total fixed assets other than land
		26	Public/EU subsidies (investment, etc.)
		27	Net investment
		28	Remuneration of factors
		29	Feed expenses per hectare
		30	Pesticides expenses per hectare
		31	Fertilisers expenses per hectare
	Other gainful activities	32	Tourism infrastructure
	Structural change	33	Agricultural holdings (farms)
		34	Conversion to organic farming
		35	Average size of (livestock) farms
		36	Proportion of area tenanted
		37	Age structure of farm managers
		38	New farm managers
		39	Succession
	Land prices	40	Shadow price of land
	Agricultural trade	41	Agricultural imports and exports
		42	Real export price
	Farm economic performance	43	Total output/total input
		44	Total subsidies/family farm income
		45	(Family farm income/family work unit)/reference income
		46	Capital; total fixed assets (value of land, permanent crops & quotas)
		47	Farm net value added
	Indicators for adoption rates of risk management instruments	48	Insurance contracts
		49	Insured area
		50	Price contracts
		51	Off-farm income
		52	Other types risk of reduction measures
		53	Other gainful activities
Environmental			
	Agri-environmental commitments	54	Agri-environmental commitments
	Land cover/Land use	55	Land use change
		56	Land cover
		57	Land use diversity (Shannon diversity)
		58	Cropping patterns
		59	Planting of non-food crops
		60	Utilised Agricultural Area/ Utilised Agricultural Area minus woodland area
		61	Area harvested per crop
		62	Area harvested - rainfed
		63	Area harvested - irrigated

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Impacts	INDICATOR THEMES	ID	INDICATOR NAME
		64	Set aside/ % of total farm as uncropped land (including fallow and set-aside)
		65	Soil cover
		66	Farming intensity
		67	Specialisation
		68	Risk of land abandonment
		69	Permanent grassland
	Feed use	70	Feed use (ruminant meat, non-ruminant, dairy)
	Energy	71	Energy use in agriculture, forestry and food industry/ Fuel quantities/
		72	Electricity costs and machinery, heating and vehicle fuels and oil per ha UAA
		73	Energy balance
		74	Production of renewable energy from agriculture and forestry
	GHG emissions	75	Greenhouse gas emissions from agriculture/farms
		76	Share of agricultural land under commitments to improve climate adaptation
		77	Share of livestock units under support to reduce GHG emissions and/or ammonia, including manure management
		78	Share of agricultural land under commitments to reducing emissions, maintaining and/or enhancing carbon storage (permanent grassland, agricultural land in peatland, forest, etc.)
		79	Share of farms benefitting from CAP investment support contributing to climate change, mitigation and adaptation, and to renewable energy or biomaterials production
		80	Carbon demand
		81	Carbon price
	Air quality	82	Share of agricultural land under commitments to reduce ammonia emission
		83	Ammonia emissions
	Nutrient (N,P) balance	84	Nitrogen from fertilisers
		85	Share of livestock units (LU) under supported commitments to improve environmental sustainability
		86	Livestock density
		87	Total and individual number of animal units (bovine, pig and poultry)
		88	Livestock units per forage area
		89	Manure management and storage
		90	Gross nutrient balance – nitrogen (farm gate)/ N surplus and N output in agricultural products
		91	Gross nutrient balance – phosphorus
		92	Gross nutrient balance – potash
		93	Nitrogen use efficiency
		94	Mineral fertilisers use
		95	Organic fertilisers use/urea quantities/manure proportion
	Water quality	96	Share of agricultural land under management commitments for water quality
		97	Share of livestock units under supported commitments to improve environmental sustainability
		98	Nitrates in ground water
		99	Percentage of farm UAA with nitrate risk
		100	Water Quality - Pesticide pollution
	Water quantity and availability	101	Water use in agriculture/ Volume of water applied to soils for irrigation purposes/Water consumption per kg of product
		102	Water abstraction/Ground water supply
	Soil quality and fertility	103	Tillage practices
		104	Soil quality
		105	Soil organic carbon in agricultural land
		106	Share of agricultural land under management commitments beneficial for soil management
		107	Diversity of crop production
		108	Soil compaction
	Soil erosion	109	Soil erosion by water

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Impacts	INDICATOR THEMES	ID	INDICATOR NAME
	Biodiversity and landscapes	110	Farming in Natura 2000 areas
		111	Genetic diversity /Number of crops/ Index of crop diversity (Shannon Index)/ Number of crops with a share of > 5% in arable farm area/Proportion of legumes in crop structure/proportion of cereals and maize/% spring crops
		112	Median parcel size
		113	Edge density (mean ratio of perimeter and surface area of land parcels)
		114	High Nature Value farmland
		115	Share of farms benefitting from CAP investment support contributing to biodiversity
		116	Farmland birds index
		117	Percentage of species and habitats of Community interest related to agriculture with stable or increasing trends/ Indices of species richness for birds, ants and herbs/ Total avian species richness and Individual and Total bird densities
		118	Natural Capital Index
		119	Land committed to conservation
		120	Agricultural land covered with landscape features / Share of landscape features in total farm area/
		121	% of total farm area that is woodland
		122	Area supported for afforestation and creation of woodland, including agroforestry
		123	Share of livestock units concerned by supported actions to limit the use of antibiotics (prevention/reduction)
		124	Percentage of grassland area that is temporary grassland
		125	Percentage of UAA that is classified as rough grazing
	Pesticide use	126	Share of agricultural land concerned by supported specific actions which lead to a sustainable use of pesticides in order to reduce risks and impacts of pesticides
		127	Share of Utilised Agricultural Area supported by the CAP for organic farming maintenance or conversion
		128	Consumption of pesticides
		129	Area treated with pesticides
		130	Crop protection costs
		131	Plant protection products
		132	Pesticide risk
		133	Pesticides in rivers
		134	Pesticides in groundwater
	Animal wellbeing (health and welfare)	135	Share of livestock units covered by supported action to improve animal welfare
		136	Feeding and nutrition
		137	Mortality rate
		138	Somatic cell count
		139	Age/quality of buildings
		140	Duration of grazing
		141	Access to outdoor areas for animals
Social			
	Employment	142	Percent employed in rural areas compared to national and other area rates for same age and sex classes
		143	Farm labour force
		144	Seasonal labour employment
		145	Work-force stability
		146	Risk of abandoning agricultural activity
		147	Economic dependence on agricultural activity
	Training and education	148	Agricultural training of farm managers
		149	Share of CAP budget for knowledge sharing and innovation

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Impacts	INDICATOR THEMES	ID	INDICATOR NAME
		150	Share of farmers receiving support for advice, training, knowledge exchange, or participation in operational groups to enhance economic, environmental, climate and resource efficiency performance
		151	Share of farmers benefitting from support to precision farming technology through CAP
		152	Share of farms with CAP risk management tools
		153	Share of farmers receiving investment support to restructure and modernise, including to improve resource efficiency
		154	Share of farmers participating in supported Producer Groups, Producer Organisations, local markets, short supply chain circuits and quality schemes
		155	Share of farmers receiving support for advice/training related to environmental-climate performance
	Quality of life	156	Satisfaction with quality of life
		157	Social diversification index
		158	Farmer wellbeing
		159	Household vulnerability
		160	Education level
		161	Work-life balance
	Community wellbeing	162	Multifunctionality (contribution to rural economy)
		163	Availability of services
		164	Food safety/ Pesticides residues in food
		165	Heritage and cultural values
		166	Consumer perceptions and concerns

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