

MEF4CAP

Monitoring and Evaluation Frameworks for the Common Agricultural Policy

Deliverable D1.2: Future CAP developments and their impacts on administrative use and data providers

Future CAP developments and their impacts on administrative use and data providers



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Acronyms

AKIS	Agricultural Knowledge and Innovation System
CAP	Common Agricultural Policy
EEA	European Environment Agency
FADN	Farm Accountancy Data Network
FSDN	Farm Sustainability Data Network
GDPR	General Data Protection Regulation
IACS	Integrated Administration and Control System
JRC	Joint Research Centre
LPIS	Land Parcel Identification System
MS	Member States
MVR	Monitoring Verification and Reporting
NDM	New Delivery Model
PMEF	Performance Monitoring and Evaluation Framework
RDP	Rural Development Programme
SEA	Strategic Environmental Assessment
NSP	National Strategic Plan

Executive Summary

This paper examines the benefits which greater agriculture related data provision and integration could deliver for administrators (governments, paying agencies etc.) and farmers. Reform of the CAP, the creation of the New Delivery Model (NDM) and the expansion of the CAP objectives to encompass wider issues of sustainability, create a need for better data provision to understand what is happening, whether policy interventions are effecting change and whether other developments in agriculture are delivering outcomes which society considers desirable.

EU agriculture and the wider agri-food chain are now under considerable pressure to provide transformative change in support of sustainability objectives in a relatively short period of time. This pressure is coming from EU and national level policy development and from changing consumer preferences. Farmers therefore need a more sophisticated understanding of the operation and impact of their farm businesses, so that they can make farm management decisions that are supportive of sustainability goals. The desired outcomes include improved incomes and better lifestyles for farmers from systems of production that enhance rather than damage the environment. Farmers therefore need data about their farming activities and need to understand how they themselves or others can analyse this data for the benefit of the farmer and wider society.

Governance of the new CAP, through the NDM, aims to better achieve EU objectives based on strategic planning, broad policy interventions and common performance indicators. The NDM provides greater autonomy and flexibility to Member States (MS) with regard to interventions and rules. Increased subsidiarity will make it possible to better take account of local conditions in the design, implementation and evaluation of policy. The key instrument designed to underpin the NDM will be the requirement for each MS to draw up a National Strategic Plan (NSP) setting out its assessment of needs, the specific CAP objectives it intends to address, its intervention strategy, including the quantitative targets it intends to achieve with respect to these objectives, and the interventions it plans to use.

MS performance with regard to planning and delivery will be assessed by the Commission ex-ante, in the interim and ex-post. Some argue that the strategic planning approach adopted will result in a substantially greater administrative burden at the MS level, especially where a regionalised model is present. Others conclude that, although the NDM provides some prospects for simplification, as the governance system remains relatively unchanged, this poses challenges for the effective administration and delivery of the policy.

Multiple sources of agricultural data now exist. Policy makers have indicated that the long established Farm Accountancy Data Network (FADN) will soon develop a broader data collection remit to reflect the wider range of CAP objectives. As a result, it will be modified to become the Farm Sustainability Data Network (FSDN).

Agriculture related data collected for a range of administrative purposes represents another major data source. Food processors and farm input suppliers also have the capacity to generate

a lot of data relating to agriculture at the level of the individual farm operator. Added to these are farm data that can be collected using new types of technology on farm.

There are obstacles to the integration of data from a range of different sources. However, technological developments in data collection, data management and data processing are taking place. These developments make the possibility of collecting additional data and merging data from various sources both technically and economically feasible. This can deliver benefits for administrators and farmers. A number of projects have already begun to explore the potential for data aggregation and the additional value this can bring for data users, be they policy makers, farmers or consumers. That said, other challenges to the sharing of data remain, particularly relating to legal issues concerning data ownership, certification and commercial secrecy. In addition, it must be recognised that farmers have rights in terms of how data relating to their activities is used. Such protections are set out in the EU General Data Protection Regulation (GDPR) which determines the actions that need to be taken when sharing personal data.

The experience of data sharing in the past has, in some instances, created a problem of trust between farmers and data collectors that needs to be addressed and overcome. In the past, there was limited emphasis on using data provided by farmers for purposes that could deliver benefits to farmers. Instead such data was used to monitor and evaluate the effectiveness of policy and to satisfy administrative needs such as regulatory compliance. Farmer co-operation in the provision of data may be more effective if sought on the basis of consent rather than making it a mandatory requirement. Users of such data need to approach the issue of data sharing in a way that also seeks to return benefits to farmers. Farmers themselves need to better understand the value which the analysis of such data can deliver, both for wider society, for the individual farmer and the farming community. It can allow farmers to make better farm management decisions, thereby contributing to the objective of improving every aspect of agricultural sustainability. There is a role for farm advisory bodies in demonstrating the value of such data to farmers and in training farmers in how they can interpret this data.

1. Introduction

This is the second deliverable of Workpackage 1 the MEF4CAP project (Deliverable 1.2). The aim of MEF4CAP is to deliver an **innovation agenda and roadmap for future monitoring of EU agriculture**. In particular the project seeks to identify the monitoring needs of the Common Agricultural Policy (CAP) 2023-2027 and beyond. Furthermore, the project will show how these monitoring needs could be better addressed using efficiencies created by technical developments, in data collection, data management and data integration. Such progress will minimise the cost of data collection and the associated administrative burden experienced by data providers and data users. These developments can also enhance the usefulness of this data to data users, including farmers themselves. In addition, progress in addressing various legal interoperability issues, primarily around data ownership, must also be made to ensure data can be utilised in an optimum way.

The objective of this deliverable is two-fold. Firstly, it explains the relevance of data collection for monitoring and evaluation purposes, particularly in the context of changes that are being made to the CAP and the implications of such changes for administrators, particularly in respect of their data requirements. Secondly, the paper recognises the considerable burden which data provision places on data providers (farmers) and explores the potentially beneficial uses this data could deliver for them. It is imperative that further consideration be given to the potential costs and benefits of collecting additional data from the perspectives of both providers and administrators. It also investigates the challenges associated with data sharing. If benefits to farmers as data suppliers can be realised, then this could alter their current perception of data provision being unduly burdensome.

Section 1 provides a context for Deliverable 1.2 and its purpose within the wider MEF4CAP project. Output from WP1 will provide guidance for some of the work undertaken in WP2 and WP3 in particular.

Section 2 describes the New Delivery Model (NDM) governing the CAP 2023-2027 and how this differs from previous approaches. The key instrument designed to underpin the NDM will be the need for each MS to draw up a National Strategic Plan (NSP). The related legislative requirements are detailed, and the means by which policy delivery will be evaluated is described. Finally, some potential administrative challenges for MS are discussed, as is the role of the Integrated Administration and Control System (IACS) in monitoring agricultural policy performance in terms of impact, results and output.

Section 3 describes the various means by which farm data are generated, including farm surveys undertaken to meet the requirements of the EU FADN and administrative data that is gathered by government ministries and paying agencies. Increasingly, data is also being gathered by private businesses and farmers themselves using new data capture techniques, involving, for example, farm machinery, farm sensors, remote sensing and customer relations management applications. The benefits for farmers that can be derived from this data are explored, as are the concerns with regard to the provision and usage of such data.

Section 4 provides an overview of some ongoing and recently completed projects in this area which are aimed at better improving data collection, integration and amalgamation. These are the BESTMAP, MIND STEP and SUPREMA projects. A further initiative, the development of the AGRIMODELS cluster brings together BESTMAP, MIND STEP and the Agricore project to improve data modelling capacity in CAP monitoring and evaluation.

Section 5 draws conclusions relating to the implications for administrations of the NDM and highlights the benefits for farmers as data providers.

The output from Deliverable 1.2 together with output already produced in Deliverable 1.1 and other workpackage deliverables (particularly Deliverable 2.1 and Deliverable 3.1) will inform Deliverable 1.3 which will provide a shopping list of policy goals and associated indicators.

This deliverable is important in that it provides a rationale for assembling a more comprehensive set of data representative of farms across the EU. This data will represent an amalgamation of data from a range of sources. The aggregation of these data sources will increase the capacity of policy makers to design, evaluate and refine policies relating to agriculture. The data can also be used to deliver direct benefits to farmers, such as the measurement of the sustainability of their activities and the identification of areas where farmers could target their efforts to improve farm productivity and profitability or deliver further desirable environmental outcomes. However, farmer concern about data provision and the potential use of this data must also be understood and addressed.

2. Future CAP developments and its impacts on administration

This section describes the NDM governing the CAP 2023-2027 and details how this differs from previous approaches. In particular, the legislative requirements in the design of NSPs will be detailed. The potential administrative challenges of this modified framework for the design, implementation and evaluation of the new CAP will then be briefly discussed. Finally, the future role of the IACS in monitoring agricultural policy performance in terms of impact, results and output is then outlined.

2.1. The New CAP Delivery Model

Governance of the new CAP, through the NDM, aims to better achieve EU objectives based on strategic planning, broad policy interventions and common performance indicators. The new approach aims to streamline governance, improve the delivery of EU objectives and decrease bureaucracy and the administrative burden (European Commission, 2018c). The NDM provides much greater autonomy and flexibility to MS with regard to interventions and rules. As a result, MS will be directly responsible for policy design, implementation and evaluation. With common policy parameters in place at the community level (objectives, broad types of intervention, and basic requirements), MS will now hold more responsibility and accountability in meeting CAP objectives and achieving agreed targets. Greater subsidiarity will make it possible to better take into account local conditions and needs, against such objectives and targets and allow for the tailoring of specific interventions (European Commission, 2018a). There remains some constraint on MS choices, such as making certain subsidies mandatory, in order to maintain the CAP's character as a common policy (European Commission, 2018b).

Under the NDM the current two pillar structure of the CAP will remain, with annual measures of general application in Pillar I complemented by measures reflecting national and regional specificities under a multi-annual programming approach in Pillar II. However, the NDM will bring both pillars under a single strategic planning process, allowing for complementarity and synergy between the two pillars (European Commission, 2018b). Pillar I will continue to support farmers through direct payments, once revised baseline requirements with regard to statutory management and good agricultural and environmental conditions (GAECs) are adhered to. The introduction of eco-schemes under Pillar I will further complement measures under Pillar II designed to incentivise the delivery of agri-environmental goods (Carey, 2019).

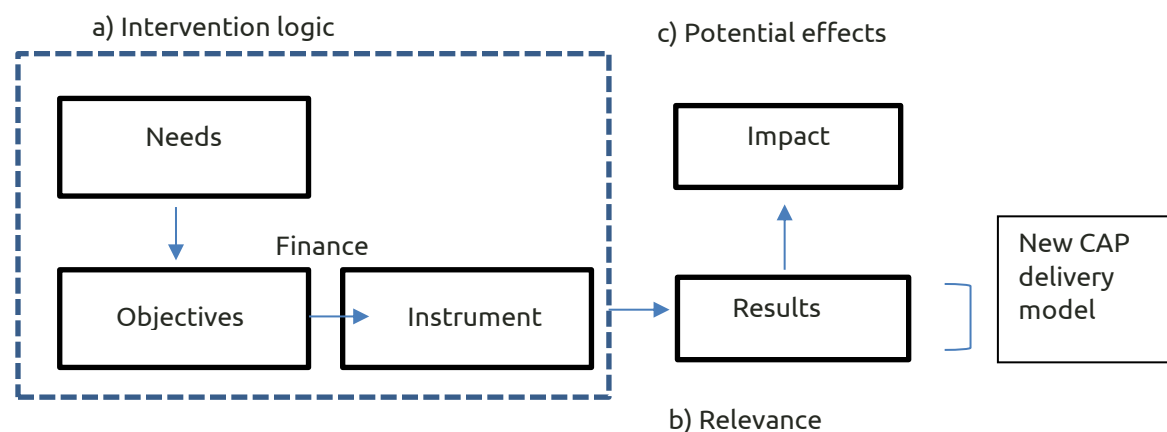
Oversight of the new CAP through the NDM will move from a compliance to a performance based approach to advance a more results-driven policy mechanism in the form of the Policy Monitoring and Evaluation Framework (PMEF). From a budgetary perspective, the new approach will allow paying agencies and certification bodies more freedom in managing the compliance and control systems in place (including penalties) within a more general set of rules at EU level. Following a budgeting strategy focussed on results and performance-oriented payments, the new framework links the eligibility of payments to actual delivery on the ground. Performance is therefore at the heart of the financial management and assurance model in the legislative proposals for the post-2020 CAP (McEldowney and Kelly, 2019).

As shown in Figure 1, Erjavec et al. (2020) outline that the CAP NDM is based on the programme logic (McLaughlin and Jordan, 1999) and prescriptive use of the policy cycle (Cairney, 2012), which should ensure:

- a) a proper definition of objectives of policy intervention based on public needs;
- b) a logical linkage between objectives and means (measures and resources available in the given contexts); and
- c) an evaluation of intervention effects.

This final evaluation stage then also enables the backward loop to inform the next policy cycle. This system is used to make sure that decisions are in line with principles of responsible public intervention when financing is approved. Additionally, elements, such as a common list of indicators and quantitative targets, serve as a tool to ensure that each step of implementation can be easily checked against the facts, i.e. is evidence-based. This is specifically important in the context of decentralised decision-making and dispersed responsibility (Cairney, 2016), which are typical in EU governance. Until now, programme logic has been systematically applied under Pillar II through the Rural Development Programmes (RDPs). Applying this approach to Pillar I is a new departure and it is expected that such programming will be a substantial administrative challenge for many MS.

Figure 1: CAP Evaluation structure



Source: Erjavec et al. 2020

The key instrument designed to underpin the NDM will be the requirement for each MS to draw up their NSP, setting out its assessment of needs, the specific CAP objectives it intends to address, its intervention strategy, including the quantitative targets it intends to achieve with respect to these objectives, and the interventions it plans to use. They will also document the financial plan, and monitoring and evaluation procedures proposed (Matthews, 2018, European Commission, 2018d).¹ NSPs are at the centre of the new performance-based delivery model, and will cover both pillars (income support, market-related instruments and rural development

¹ The Strategic Plan covers the period January 1st 2021 to December 31st 2027.

policy) as well as (to a certain extent) national measures (Erjavec et al. 2020). A detailed description of the required structure for NSPs, as per the legislation, is contained in section 2.2.

In the design of plans, each MS has first been required to liaise with the Commission, hold consultations with experts and stakeholders, and undertake an extensive SWOT (strengths, weaknesses, opportunities, and threats) analysis of their territory and agri-food sector needs across the nine CAP objectives. The legislative proposal indicates that the SWOT analysis should provide “a comprehensive overall description of the current situation of the area based on common context indicators and other quantitative and qualitative up-to-date information such as studies, past evaluations reports, sectoral analysis and lessons learned from previous experiences” (European Commission, 2018c). It should also include an analysis of issues relating to young farmers, such as access to land, land mobility and land restructuring, access to finance and knowledge and advice and capacity to cope with risk. Relevant information about the functioning of the MS' agricultural knowledge and innovation systems (AKIS) and related structures should also be included. The adequacy of the SWOT analysis will be an important element when it comes to the Commission's assessment of each plan. With regard to MS' assessment of needs, the Parliament's AGRI committee inserted a provision stipulating that a reference to animal welfare be included alongside an explanation of how the NSP is meant to contribute to the objective of improving animal health and welfare and reducing antimicrobial resistance (McEldowney and Kelly, 2019).

An ex-ante evaluator must then appraise the assessment of needs. MS are required to set target values and benchmarks for all common and specific indicators within the SP and a particular emphasis on environment and climate action will have to be included. A review of interventions pertaining to generational renewal and the facilitation of business development is also required (Erjavec et al. 2020).² All needs addressed by the NSP will have to be described in detail, prioritised, and their choice justified on the basis of the latest available and most reliable data (European Commission, 2018c). The plans should be based on a clearly established intervention logic and must ensure that their actions, including those outside the CAP framework, do not distort the common market.

Erjavec et al. (2020) and others have warned of the potentially excessive administrative burden of growing data requirements within the new CAP. Lessons can be learned from previous reforms in this regard, i.e. the Ecorys (2018) evaluation of the 2013 CAP reform concluded that the administrative burden had increased for administrations but not for beneficiaries.³ The report recommended that administrative cost implications of MS interventions should be considered in future CAP NSPs and the use of digital technology increased. As such, there appears the need for a well-defined approach across MS and a comprehensive cost-benefit analysis with regard to the collection of additional data from both the perspectives of data providers and administrators. The Ecorys (2018) report also highlighted the lack of data

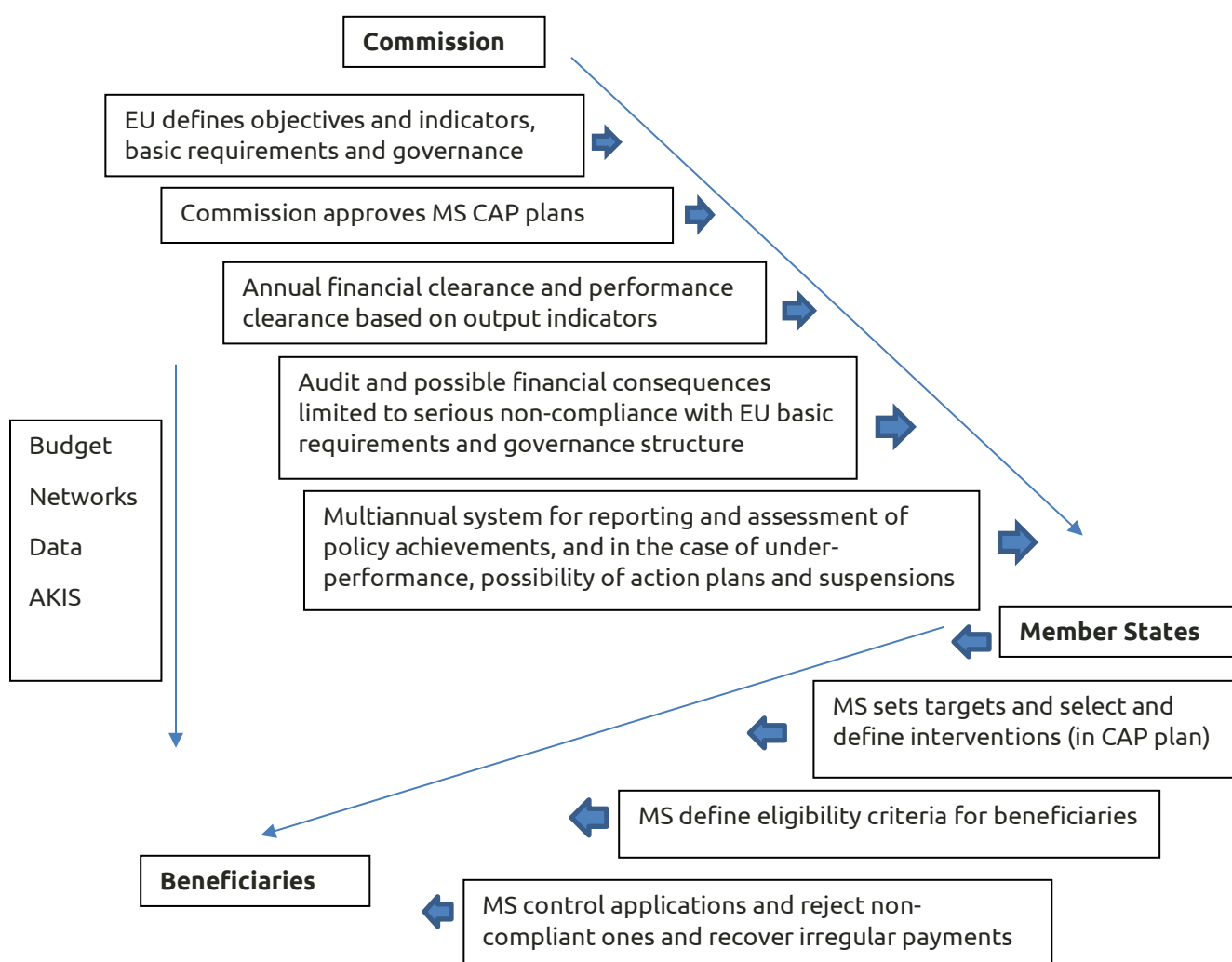
² See EU Commission (2021) for a comprehensive evaluation of the impact of the CAP on generational renewal, local development and jobs in rural areas.

³ See Ecorys (2018) for detail on the definitional differences between administrative burden and costs. Within the study, administrative costs take account of transaction costs for authorities (public) and farmers (private). These can be further disaggregated into compliance costs and administrative burdens.

relating to CAP implementation costs for administrations, which makes MS comparisons more difficult. All plans are submitted to the European Commission for evaluation and approval before they are implemented. They then provide feedback and specific recommendations to MS in the finalisation of plans.

The process involved in the design, approval, implementation, evaluation and certification of the CAP within the NDM is illustrated in Figure 2. This also reflects the relationship between the Commission, MS and beneficiaries.

Figure 2: The new relationship between the EU Commission, Member States & Beneficiaries in the delivery of the CAP 2021-2027



Source: Commission 2018d

In December 2020, having reviewed MS NSPs, the Commission published country specific recommendations in relation to a number of broad aims:

- Fostering a smart, resilient and diversified agricultural sector ensuring food security;
- Bolstering environmental care and climate action and contributing to the environmental- and climate-related objectives of the union;
- Strengthening the socio-economic fabric of rural areas and address societal concerns;
- Fostering and sharing of knowledge, innovation and digitalisation in agriculture and rural areas.

The PMEF requires each MS to submit an annual performance report to show progress towards the targets that have been set within their NSPs in the form of output, result and impact indicators. According to Carey (2019), the additional requirement for indicative financial allocations within the plan adds to the complexity and administrative burden for MS, particularly in the design of multi-faceted and multi-annual interventions. In the case of more than a 25% deviation from a milestone, a specific remedial action plan may be required. In assessing MS performance the Commission will undertake an annual performance clearance and review and an interim evaluation in addition to an ex-post evaluation which will also involve the MS itself.

If deviations emerge from planned and actual output and expenditure at the first stage, (performance clearance) justification is required to prevent a reduction or suspension of funds. Result indicators included in the annual performance report are assessed at the second (review) stage. The NDM also proposes a single audit approach, whereby national administrations and independent certification bodies will approve governance structures. The latter will verify that information in the annual performance report is reflected in the IT systems of the national administrations. This approach avoids the need for multiple audits by the Commission and European Court of Auditors (Carey, 2019).

According to Erjavec et al. (2020), the NDM promotes less ambition across MS to satisfy result-based targets. Similarly, Carey (2019) argues that the existence of strict sanctions may encourage national administrations to adopt less ambitious interventions, even though engagement between MS and the Commission is provided for in the event of any discrepancy.

The key differences between old and new CAP delivery mechanisms are contained in Table 1.

Table 1: Old v New CAP delivery mechanisms

Issue	CAP 2014-2022	CAP 2023-2027
Objectives and targets.	The CAP as a whole evaluated against objectives in EU law, but MS not required to contribute to these. Instead, MS must comply with detailed spending rules and target their RDP spending according to a SWOT analysis of their own circumstances. No objectives are required by the EU for MS Pillar I expenditure.	MS to draw up single strategic CAP plans covering both Pillar I and Pillar II to deliver agreed contributions to the EU-level objectives based on a needs assessment.
Design of measures.	All measures in both pillars are designed in detail at EU level although many offer choices to MS.	Direct payments to be compulsory and designed (with some flexibility for MS) at EU level. The EU would define the range of other acceptable “intervention types”, but MS would design and choose the specific measures.
Scope for MS to select and vary policy instruments.	MS choose policy options within Pillar I (e.g. which if any sectors to offer coupled payments to) which is otherwise compulsory. They both choose and target measure types within their RDP. A minimum 30% RDP spend applies to environmental and climate measures. Some flexibility between Pillars is allowed.	MS would need to justify their choice of intervention to the Commission, but would have a free choice unless the Commission made some other type of interventions (in addition to direct payments) compulsory. Some flexibility between pillars allowed.
Basis of EU payment to MS.	For compliance with EU law including detailed rules.	Payment is for the delivery of the CAP plan. Targets must be met through result indicators showing delivery by the MS of its chosen interventions. The performance management will include consideration of the extent to which impact on objectives has been achieved.
In case of deficient delivery.	MS must return money recovered from beneficiaries to EU budget. EU issues financial corrections to MS.	MS recycle money recovered from beneficiaries to their national budgets. EU reduces payment for non-delivery of CAP plan but financial correction (additional penalty for systemic failure) only happens if a MS fails to comply with one of the few legislative requirements.

How payments are controlled.	<p>EU law lays down specific rules about compliance checks, including their frequency, which the EU audits.</p> <p>MS must maintain a Land Parcel Identification System (LPIS) as well as digitised Geographical Information Systems maps with layers of detail (specified in legislation) intended to enable checking of detailed eligibility rules mostly set at EU level.</p>	<p>MS would design their own compliance systems but would need to satisfy the EU that they were adequate.</p> <p>Annual review of expenditure by the Commission.</p> <p>LPIS supports the compulsory direct payments system.</p>
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Source: IEEP (2018)

2.2. The Structure of CAP Member State Strategic Plans

The procedural requirements for drawing up the NSPs and their required structure is summarised here, informed by the relevant regulation COM/2018/392 final - 2018/0216 (COD) (European Commission, 2018d) and a synopsis by Matthews (2018) and Erjavec et al. (2018).

Procedural requirements (Art 94)

Transparent procedures should be adhered to by MS when preparing their NSP. The competent regional and local authorities, including relevant public authorities, economic and social partners, and relevant bodies representing civil society, should be involved. Specifically, the competent authorities for environment and climate should be effectively involved in the preparation of the environmental and climate aspects of the plan.

Elements making up the Strategic Plans (Art 95-103)

a) Assessment of needs.

The plan should include an identification and description of needs for all nine specific objectives of the CAP, even if these are not addressed within the NSP. Needs in relation to risk management in connection with the specific objective of support for viable farm incomes and resilience should be specifically described. These needs should then be ranked and prioritised and a sound justification of the choices made should be given, including why certain identified needs might not be addressed or only partially addressed in the NSP. Matthews (2018) notes that, while this suggests that MS may decide not to pursue one or more of the specific objectives if they can provide appropriate justification, in practice the mandatory nature of the agri-environment-climate interventions and the existence of the performance bonus, makes the inclusion of the related specific objectives for the general environment and climate objective also mandatory.

b) Intervention strategy.

This section should set out quantitative targets and milestones to achieve each specific objective that is addressed in the NSP. Targets should be defined using a common set of result indicators. Although how this will be achieved remains unclear. The value of the targets should be justified by reference to the needs assessment. The intervention strategy should also set

out the interventions proposed, their intended use and how they are mutually coherent and compatible.

Additional specific requirements include

- i. an overview of the environmental and climate architecture, showing the complementarity and coherence between the proposed conditionality attached to receipt of farm payments, the eco-scheme in Pillar I and the Agri-Environment Climate Measures in Pillar II, and how this architecture contributes to meeting long-term national targets set out in relevant environmental legislation;
- ii. in relation to the specific objective 'attract young farmers and facilitate their business development' the overall package of measures included in the plan should be described, including their interplay with relevant national instruments;
- iii. where coupled supports and other sector-related interventions are included in the plan, the justification for targeting the sectors concerned, the list of interventions per sector, their complementarity, as well as the possible specific additional targets related to the interventions should be described;
- iv. an explanation as to which interventions will contribute to ensure a coherent and integrated approach to risk management.

c) Description of elements common to several interventions.

A number of disparate requirements are included here. The most important is a description of the system of conditionality, including a detailed account of how each GAEC standard in the regulation will be implemented and, specifically, how it will contribute to the environmental and climate specific objectives. MS should also include information on the specific definitions adopted (e.g. definitions of agricultural activity, agricultural area, eligible area, genuine farmer, small farm and young farmer); on the use made of technical assistance; on the functioning of payment entitlements where the MS opts to continue their use; on the uses made of revenues raised by capping and degressivity; as well as an overview of the coordination, demarcation and complementarities between the European Agricultural Fund for Rural Development (EAFRD) and other Union funds active in rural areas. In the design of individual policy instruments at MS level, questions remain as to how best to evaluate particular measures across MS within the common PMEF.

d) A description of the direct payments, sectoral and rural development interventions specified in the strategy.

This should include an account of the design of the intervention and its eligibility conditions, the annual planned outputs for the intervention, the annual planned unit amount of support and its justification; and the resulting annual financial allocation for the intervention. MS should also show how the intervention relates to the criteria for determining whether measures are trade-distorting or not in the WTO Agreement on Agriculture, and whether the intervention falls outside the scope of Article 42 of the Treaty of the Functioning of the EU (TFEU) and is subject to State aid assessment.

e) Target and financial plans.

These should build on the annual financial allocations per intervention set out in (d) as well as detail transfers between pillars and confirm that any minimum spending requirements set down in the regulation have been met.

f) A description of the governance and coordination system.

The most important element here is information on the control system and penalties, including the IACS and the control and penalty system for conditionality. The monitoring and reporting structure should also be described.

g) A description of the elements that ensure modernisation of the CAP.

This covers two specific obligations; an overview of how the NSP will contribute to the fostering and sharing of knowledge, innovation and digitalisation and encourage their uptake, including a description of the AKIS organisational set-up and how advice and innovation services are provided; and a description of the strategy for the development of digital technologies in agriculture and rural areas and for the use of these technologies to improve the effectiveness and efficiency of the CAP NSP interventions.

h) A description of the elements related to simplification and reduced administrative burden for final beneficiaries.

The legislative proposals direct that the following annexes also be included: (i) the ex-ante evaluation and the strategic environmental assessment (SEA); ii) the SWOT analysis; (iii) consultation of the partners; iv) crop-specific payment for cotton; and v) additional national financing provided within the scope of the NSP. Annexes i-iv, as well as the MS plans for controls and penalties, are explicitly excluded from the approval process.

In the last Parliament, the AGRI committee voted amendments to the proposal to extend the number of annexes to eight by including a provision for an annex on the schemes for the following: climate, environment and animal welfare; regional intervention programmes; and elements of the SP that contribute to increasing competitiveness.

The Commission can query elements of a NSP within three months of receipt, whereby the MS is required to provide any additional information and, if necessary, to revise the proposed plan. It is further specified that approval should not take longer than eight months after submission (but this time limit excludes any time required for a MS to respond to Commission observations). Partial approval of elements of the plan is also permitted. MS can amend their plans at any stage by following the prescribed procedure.

Table 2 provides a summary of the main elements required in the design of MS Strategic Plans.

Table 2: Summary Information required for completion of MS Strategic plans

a) Assessment of needs	<ul style="list-style-type: none"> - Summary of the SWOT analysis. - Identification of needs for each specific objective (specifically for risk management and vulnerable geographical areas). - National and environmental plans. - Sound justification of choices.
b) Intervention strategy	<ul style="list-style-type: none"> - Targets and milestones based on a common set of result indicators for each specific CAP objective. - Overview of planned interventions contributing to results, incl. financial allocations and explanations of how the intervention contributes to targets based on a sound intervention logic, coherence and compatibility. - Consistency and complementarity in climate and environment (no backsliding), generational renewal, sectorial overview, risk management, interplay between national and regional interventions.
c) Common elements	<ul style="list-style-type: none"> - Definitions such as Agricultural Area, Agricultural Activity, Genuine and Young Farmer. - Minimum requirements for decoupled aids. - Conditionality: description of GAECs and their contribution to objectives. - Technical Assistance and CAP network. - Other implementation information: entitlements, product of reductions, co-ordination and demarcation between the EAFRD and other Union funds.
d) Interventions	<p>The description shall include elements such as:</p> <ul style="list-style-type: none"> - Territorial scope - Requirements - Eligibility conditions - WTO green box compliance (where relevant) - Planned outputs, financial allocations (annual breakdown) - Variation of unit amount (area and animal payments) and method - State aid considerations (where relevant)
e) Target and financial plans	Overview tables

f) Governance and co-ordination systems	Governance bodies Control system and penalties including IACS, conditionality, bodies responsible for checks, monitoring and reporting structure.
g) Modernisation	Description of the organisational set-up of the AKIS and provision of advice and innovation support services. Strategy for the development and use of digital technologies.
h) Simplification	A description of the elements related to simplification and reduced administrative burden for final beneficiaries.

Source: European Commission 2018d

2.3. Potential Challenges

Simplification and modernisation were the two over-arching objectives of the Commission's CAP proposals, with strategic planning put forward as a progression in evidence-based policy-making, enabling greater flexibility for MS and the efficiency of the policy. However, many have questioned whether the new process actually signifies a real simplification in the implementation of the CAP. Indeed, according to Matthews (2018) the strategic planning approach will result in a substantially greater administrative burden at the MS level. This is reiterated by Erjavec et al. (2020), who cite the issue of administrative capacity, the limited experience of MS in the programming of Pillar I and the administrative challenge of accounting for potentially complex eco-schemes for many MS. Similarly, Cagliero et al. (2021) and García Azcárate and Folkesson (2020) contend that given the increased organisational effort required on the part of MS (especially where a regionalised model is present), the approach may be overly complex. Carey (2019) contends that further simplification is required to avoid additional unnecessary and administrative burden for national administrations. The analysis by Ecorys (2018) concluded that this had indeed been the case with the 2013 reform, therefore adequate learnings should be developed based on previous experience in this regard.

According to Erjavec et al. (2018), the NDM provides some prospects for simplification, but given an inherently unchanged governance system (Jongeneel et al., 2019), the key question is therefore how the proposed NSPs will be applied in the real world and whether or not they will deliver a more effective policy. They suggest the need for improvements relating to analytical support and a more inclusive preparation process, while underlining the importance of a smooth implementation process which rewards ambition. Furthermore, given the varying success of previous RDPs, on which CAP strategic planning is built, a significant differentiation in the quality of MS implementation is to be expected. Explicitly, they assume that while some countries will be able to take advantage of greater flexibility to create more targeted measures and better policy, for others it may represent a considerable planning and implementation challenge e.g. those MS with a regionalised model. This applies to both decision-makers and beneficiaries. For a number of MS, the transition towards a strategically oriented and

performance-based agricultural policy will prove to be a daunting task that will require increased efforts in terms of substantially upgrading strategic, analytical and administrative capacities, procedures and methods of work. Meeting the environmental and conservation objectives represents a particularly critical point in this sense (Erjavec et al. 2018).

This issue of a “level playing field” has been much discussed, in particular as some MS are more advanced than others in the use of new technology for monitoring purposes. With regard to ensuring continued value for money, although some compliance checks can be aided by technological improvements (e.g. satellite data), further simplification is required to avoid additional unnecessary and administrative burden for national administrations (Carey, 2019).

With regard to strategic planning Erjavec et al. (2018) highlight the risk that national priorities may not necessarily reflect EU-level priorities, and reiterate the complex task in striking a balance between flexibility, subsidiarity, a level playing field and policy control. Erjavec et al. (2020) also contend that with respect to the SPs, stakeholder involvement commitments are rather weak, raising possible issues with transparency, lobby groups and accountability. They propose the need for safeguards to ensure effective engagement with civil society both in contributing to the design and in monitoring the progress of SPs. Finally, they make the point that climate change adaptation and environmental protection may be best addressed through action at the community level. Overall, Erjavec et al. (2020) conclude that the next CAP period will be a period of learning, in which the quality of data sources must be significantly increased, with systematic monitoring of the measures and their effects. To this end, they identify roles for both MS and EU bodies such as the Joint Research Centre (JRC) European Environment Agency (EEA) and Eurostat.

2.4. Potential for increased role of FMIS and IACS

The significance of digitisation in agriculture (precision farming and smart farming), to meet the growing economic, ecological and social demands in the agri-food sector was highlighted by Munz et al. (2020) who contend that management skills of agricultural entrepreneurs increasingly determine the success of on-farm technologies.⁴ The concept of Big Data supported by new technologies, such as cloud computing and internet of things (IoT), is expected to help put the smart farming approach into practice. Munz et al. (2020) contend that strategies should be strongly context-based, with information inter-connected from diverse sources (e.g. public data, business operational data, weather data, machinery data, sensor data) as well as that automatically processed. The objective should be the creation of a “system of systems” that combines several (closely linked) products and services. Farm Management Information Systems (FMIS) have a role in this process, having evolved from simple farm record keeping into sophisticated and complex systems to support production management. See

⁴ Precision farming is defined as an information-led management concept in both plant and animal production that is based on a wide range of technologies. Smart farming relates to a knowledge based approach in which machines can at least take partially autonomous decisions in collaboration with management systems.

Fountas et al. (2015) for a review of advancements in the functionality of academic and commercial FMIS.⁵

Similarly, the FUTUREFARM FP7 project highlighted the need for integrated ICT adoption in agriculture and improved communication between sectors.⁶ To this end, the utilisation of FMIS will be important, providing tools and systems tailored to farmers' information needs. FMIS are in use across the EU, with varying levels of adoption by MS and by farm system. This may represent a potential source for farm data. However, given the large variety of FMIS in use, standardisation of data for use outside of the FMIS could be challenging. Added to that is the fact that the population of farmers using FMIS is unlikely to be representative of farmers in the general farmer population, meaning that it would be difficult to generalise conclusions for the full farm population based on the data obtained from farms using FMIS.

The IACS is currently used to govern CAP direct payments and is a valuable source of high-resolution, spatially explicit information on the type and intensity of agricultural land-use. As outlined in D3.1, the system allows MS to control and manage, in a standardised way, the CAP income support to farmers. More precisely, it ensures that transactions financed under the area and animal-based aid schemes are carried out correctly, prevents, discovers and follows up on irregularities, recovers unduly paid amounts and supports farmers in making correct applications.⁷ Indeed, the 2018 report by Ecorys described it as a fundamental tool to assist in the achievement of CAP objectives and the management of the risk to the EAGF/EAFRD. Current use of the IACS is limited due to a) a range of diverse implementations across MS and b) the lack of agro-environment data (www.niva4cap.eu). As MS are required to develop and adapt systems and processes to meet both policy and technological requirements, the harmonisation of IACS across the EU would be a worthwhile exercise. This would be of particular benefit in allowing better monitoring of the environmental and climate performance of agriculture in terms of impact, results and output.

According to the EU Commission (2018d), in order to advance towards a more result-driven policy mechanism, there will be a shift from assurance on legality and regularity of the underlying transactions to assurance on performance and the respect of EU basic requirements. As such, the regulation states that robust and reliable governance structures in the form of IACS, paying agencies, coordinating bodies, competent authorities and certification bodies will be required. Given such potential for the IACS and the possibility for synergies with the CAP and environmental and societal policies, the operability of the system and usability of data must be considered. As such, Tóth and Kučas (2016) have proposed the establishment of

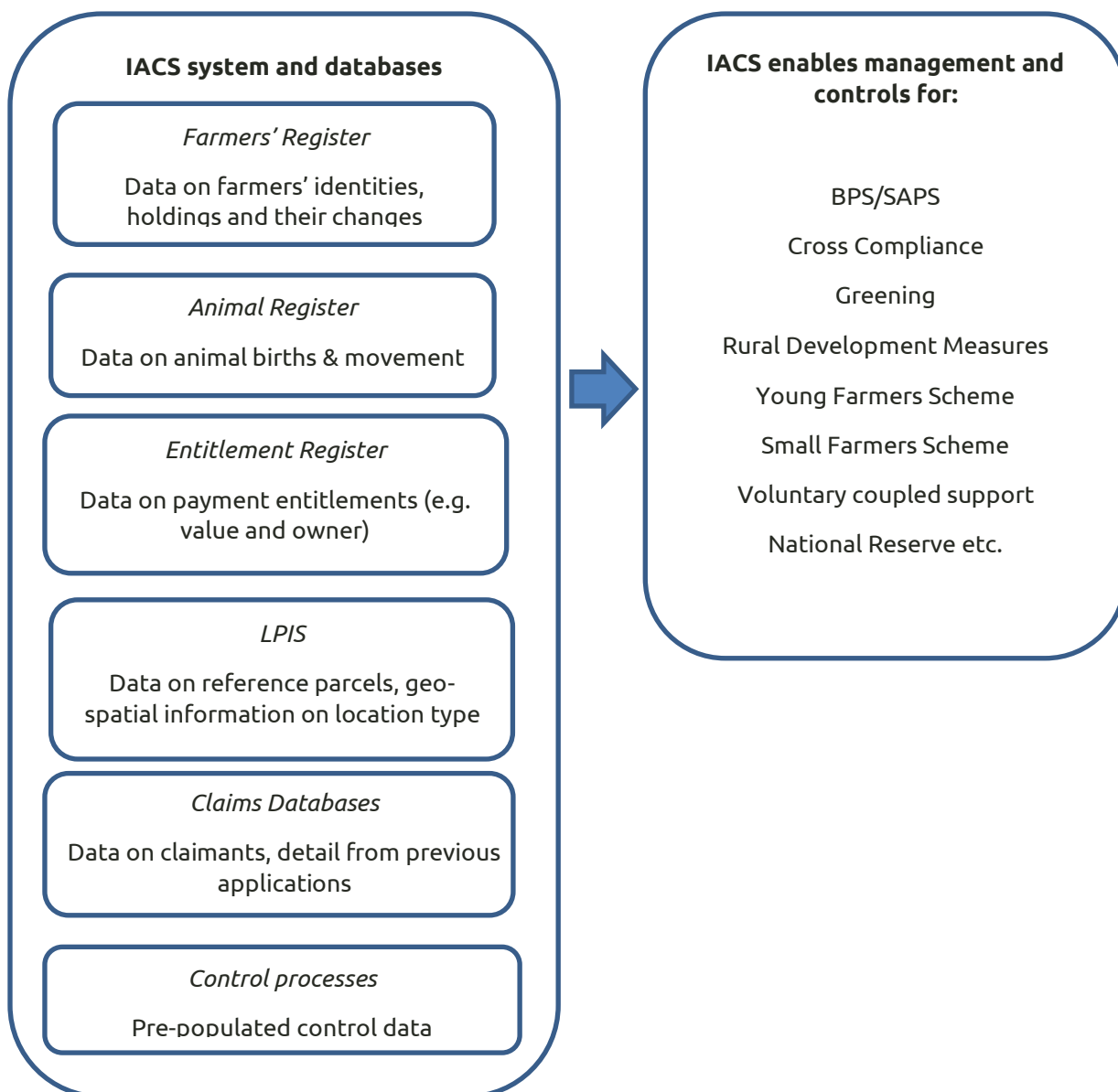
⁵ Academic FMIS cover compliance and standards application and automated data capture as well as interoperability between different software packages. Commercial FMIS applications target everyday farm office tasks related to budgeting and finance, such as record keeping, machinery management and documentation, with emerging trends showing new functions related to traceability, quality assurance and sales.

⁶ <https://cordis.europa.eu/project/id/212117/reporting>

⁷ https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/financing-cap/financial-assurance/managing-payments_en

an updated IACS framework, a domain model that is standards based, allows flexible extensions, and that supports efficient implementation and information exchange between stakeholders. Likewise, through the ongoing NIVA project (www.niva4cap.eu), a new vision for IACS is envisaged, whereby the integration of IACS with external data is proposed to facilitate further data and information flows for stakeholder use. That said, a number of technical and legal interoperability issues must be considered in assessing the feasibility of integrating datasets in this way. Deliverable 3.1 concludes that improving the interoperability and, to the extent possible, the harmonisation of administrative and statistical databases would exploit the synergies between them for monitoring and evaluation purposes, while reducing the collection burden in terms of time (for farmers and surveyors) and costs. A graphical representation of the data contained in IACS and the purpose for which it is currently used is contained in Fig. 3.

Figure 3: IACS and its main components and uses



Source: Ecorys (2018)

Deliverable 2.1 considers whether it is possible to utilise existing data sources more efficiently, avoiding duplication and potentially allowing scope for the collection of new types of data. For example, the potential use of data from IACS and other sources could allow the scope of the FADN to change to incorporate new data in evolving areas of interest. As new technical developments are enhancing the capability of providing, retrieving and integrating new data sources, Deliverable 2.1 presents an extended technological review assessing established technology services and more advanced approaches to manage agricultural data flows.

3. Beneficial Use of Data for Farmers

While the relevance of data collection for monitoring and evaluation is clear, it can place a considerable burden on data providers (farmers). Therefore, in this section the potentially beneficial uses this data could also deliver for farmers themselves will be explored. If benefits to data suppliers can be realised, then this could alter the perception of data provision being unduly burdensome from the farmer's perspective.

3.1. FADN Data

The leading source of representative EU farm level data is the FADN. Farmers who participate in the FADN each year do so on a voluntary basis. Participation in the FADN creates a burden on the 80,000 or so participating farmers, in that it requires record keeping on the part of the farmer and a time commitment on their part to allow interaction with the organisation in their MS responsible for collecting the farm level data.

Participating farmers trust the FADN to use their data appropriately. FADN data is published in an aggregated form, with information provided for specific categories of farm e.g. size, system. In general FADN is used for administrative, policy and research purposes. Currently the analysis of FADN data is primarily of use to European Institutions and MS governments. More detailed anonymised FADN data is made available on application to individual researchers under strict terms set out in a user agreement.

Changes in technology can also facilitate more effective data collection, data management and data processing through the FADN. The analysis of FADN data can benefit farmers in the aggregate, including farmers who are not FADN participants. However, due to the nature of the analysis that is conducted, FADN data are currently unlikely to provide individual benefits to participating FADN farmers. In principle, the FADN data that are collected could be used to help farmers to make better farm business decisions.

However, statistical purists might argue that making use of FADN data to facilitate the participating FADN farmers could compromise the representivity of the farms that are surveyed, making FADN survey data less accurate as a true description of the farm population. This is because the knowledge that FADN participant farmers could glean from the analysis of their FADN data might indeed allow them to make better decisions. This would then lead to an improvement in individual farm performance for example, that could cause the FADN sample to over-estimate the performance of the wider farm population. However, the European Commission's 2021 Roadmap communication on a future FSDN specifically seeks to provide benefits to farmers in exchange for the provision of their data (European Commission, 2021).

3.2. Other Existing Sources of Farm Level Data

Administrative data is collected in some MS to track, amongst other things, animal births, animal movements, animal slaughterings, crop areas and input sales volumes. Administrative data on the level of support received by individual farms is also held by paying agencies. This data can be highly detailed and there is the potential to make this data available for analytical purposes that could benefit farmers.

The **food processing industry** is also a repository of data relating to farm performance. This data can relate to the quantity, quality and value of the outputs produced by the farmer. It can also relate to the quantity, quality and value of farm inputs purchased by the farmer. The wider farm services sector also holds valuable farm level information relating to the quantity, quality and value of key inputs which farmers purchase such as feed, fertiliser, fuel, medical products, pesticides and professional services. Financial services' providers represent a further source of data relating to farm financial transactions.

Across the EU, **farm advisory/extension services**, represent another repository of farm level data. In some MS this activity is State led, in others this activity is entirely privately funded and a third group of MS have a hybrid model with both publicly funded and private advisory services capable of collecting farm data. Data collected through these activities could be more widely used, to benefit policy making, to better understand farm productivity and farm practices and to provide greater benefits to farmers, beyond those currently available to them through the advisory services.

However, in drawing general conclusions about the farm population, one limitation of this advisory data is that it is unlikely to be representative of the full farm population. A number of issues arise in this context. Firstly, some farmers do not engage with farm advisory services. Therefore, farm advisory data will not capture data from farms that are not clients of farm advisory services. Secondly, the performance of farms which receive farm advice may differ from farms that do not. This difference may reflect the benefit that is derived from farm advisory support or alternatively it may signal that farms which avail of advisory support tend to already have a stronger focus on the adoption of actions that improve farm performance, relative to farms that do not seek such advice.

3.2. New Sources of Agricultural Data

In addition to FADN and administrative data sources, additional data gathering approaches, which in the past might not have been feasible, have now become possible. Using so called Digital Technologies, sometimes referred to as either Smart Farming or Precision Farming, it is now possible to create an abundance of additional farm level data. These forms of data can be developed through remote sensing (satellite imagery), farm machinery or on farm sensors. The practical utilisation of such augmented data sets (often from a number of sources) requires the existence of adequate structures to ensure practical use i.e. the requirement for indicator operational definitions, suitable models, analytics and most importantly user buy-in and acceptance (particularly farmers).

These technologies provide farmers with better information and reduce the amount of guesswork and intuition required by the farmer in making better farm management decisions based on the information available to them. Analysis of farm data can help to automate decisions that would otherwise be time consuming and impractical for the farmer to evaluate (Datafloq, 2015; Kempenaar et al., 2016).

Such technologies have now begun to be adopted on farms, but the acceleration and mainstreaming of these technologies could bring benefits to the wider farming community.

These data serve a range of purposes which can benefit the farmer (Bronson and Knezevic, 2016). For example they can be used to:

- increase yields, helping to deliver more food production per hectare
 - better crop choices and superior variety and species choices
- lower production costs, through reduced input use per unit of output
 - reduced fertiliser and pesticide use through precision application
 - reduced usage of antibiotics and other animal medicines through better knowledge of individual animal health
 - optimisation of feed use through precision feeding techniques
- help to achieve environmental compliance, reducing the environmental impact of production
 - lower GHG emissions to address climate change
 - lower ammonia emissions to address water and air quality and maintain farmland biodiversity
 - reduced water pollution
 - protection and enhancement of biodiversity
 - support for organic farming
 - maintain and improve animal welfare
- create greater transparency in the food chain, with more visibility on how food is produced and what has been used in its production
 - maintain and improve animal health
 - maintain and improve human health
 - provide customers with more information on which to base buying decisions
 - ensure that farmers who choose production systems that better reflect consumer expectations are then rewarded through higher prices for their output
- provide farmers with real time information which can be used to influence input usage and production outcomes
 - better understanding of actual and forecast weather risks and required actions
 - better understanding of plant and animal disease risks and required actions

3.3. Creating trust to facilitate co-operation and maximise the value of data

Farmers can have mixed feeling about sharing their data with others (Wiseman et al., 2019). While farmers understand that data could be used for their benefit, they are also aware that this data could be used to their disadvantage (Ferris, 2017). It has been argued that crowd sourced data benefits the 'elites' rather than the crowd (Qualman, 2009). For example, farmers may be concerned that their data could provide others with a detailed knowledge of their overall farm performance or specific actions taken on their farm. In turn this could provide business customers with evidence to allow them offer farmers lower prices for farm outputs or could allow suppliers to charge farmers higher prices for farm inputs (Regan, 2019). Therefore farmers can be suspicious of the motivations that lie behind requests for data sharing.

In agreeing to share their data, farmers need to be confident that their data will be used to benefit them and that they will have control of how the data is used and who gets to use it (Regan, 2019). Where data collectors adhere to the GDPR, this should in principle ensure that data is only used for the purposes to which farmers have consented. However, there remains an issue of trust for farmers. Research by Zhang et al., (2017) and Turland and Slade (2019) suggests that farmers have greater trust when providing their data to researchers than they do if providing data to businesses or government. Ferris (2017) argues that trust can be increased through stronger regulation around privacy issues.

Research by Van der Burg et al. (2020) also suggests that developing trust may be a better strategy in ensuring farmer co-operation in farm data collection activities than a strategy that seeks to make data provision mandatory. The FADN has always functioned on the basis that farmers provide their data on a voluntary basis and this suggests that a degree of trust is present between the farmer and the FADN representatives.

The issue of trust may become even more important when data requests cover issues which farmers (and other members of society) would consider more personal or sensitive. Historically farm data collection was often focused on data relating to farm performance, which largely involved the measurement of farm outputs and farm inputs, the calculation of farm income and various agronomic measures relating to aspects of farm productivity. However, data relating to the farmer and other farm household members have become increasingly relevant for both policy and research, particularly with regard to social sustainability. This data can be sensitive and can involve the discussion of topics which would go beyond the perimeters of a normal farm related conversation between a data recorder and a farmer. Therefore, the issue of trust and the relationship that exists between the farmer and the data recorder become even more important when more personal topics are the subject of data collection.

It may also be important to consider cultural differences in the context of trust and co-operation. Issues of privacy and the relationship between the citizen and the State are not uniform across the EU. In some MS the rights of the individual over the State are asserted more strongly and individuals may feel under less of an obligation to co-operate for “the greater good”. The same issues may apply across different generations, with older generations more sensitive to issues of privacy than younger generations (Miltgen and Peyrat-Guillard, 2014).

Overall, trust can be an important dynamic in facilitating data provision and while the delivery of benefits to farmers from the data collection process is important, it may not be sufficient to motivate data sharing unless the issue of trust in the relationship between the farmer and data collector has also been successfully addressed. However, it is not all about delivering benefits to farmers in order to secure co-operation. Creating an environment where trust develops is a critically important in ensuring farmer co-operation in the data collection process. Farmers also need to understand that their data can provide benefits for the greater good of their sector and wider society.

3.4. Analysis of individual farm data vs data from multiple farms

The provision of data by farmers can deliver benefits to the individual farmer, other farmers and non- farmers. The issue of whether a farmer should allow farm data to be used for a purpose that could benefit another farmer is a complex one.

Farmers may consider that the sharing of their data with other farmers could put them at a disadvantage, particularly in sectors where the concentration is high and where a farmer may perceive other farmers as competitors rather than comrades (Jakku et al., 2019). However, if farmers do not consider each other as rivals, then it may make sense to share farm data so that the data from multiple farms can be analysed. This aggregated data analysis has the potential to be more useful than the analysis of data from a single farm.

Again, farmers may be concerned about the analysis of aggregated data from multiple farms if that data becomes available to third parties. Farmers can be concerned that such data can reveal details which would be commercially useful to others actors in the agri-food chain. The statutory requirements of “Privacy by Design”, a component of GDPR should provide some protection here.⁸

Farmers themselves may not be able to conduct analysis relating to multiple farms themselves. For practical purposes it may make sense for a third party to act as the data aggregator. Research indicates that farmers are more comfortable sharing data with researchers rather than government. In the case of data sharing with government the concern may relate to expectations that the data could be used to check whether farmers have complied with regulations.

3.5. Creating awareness amongst farmers in how to make the best use of their data

One of the issues that emerges in facilitating the use of farm data by farmers themselves is the ability of farmers to appreciate the value that can be derived for the farmer from the analysis of such data. Some farmers may have a strong preference for decision making processes that rely exclusively on a farmer’s pre-existing farming knowledge and the farmer’s instinct, although younger farmers with more recent experience of formal education may already understand that this form of data analysis can be useful.

Some farmers who work off farm may have little time or little appetite for sophisticated farm business planning, which they may perceive as potentially time consuming and act as an obstacle to undertaking “real” practical farm work in the limited hours available to them. Therefore, in cases where farmer are unaware of the value of farm data analysis, it will be desirable to demonstrate to farmers the benefit that can be derived from data analysis.

Separately, there may be a need to provide farmers with the knowledge to conduct data analysis themselves or to explain how their data can be analysed by others, such as a farm advisor, on their behalf. Farmers may also need to understand the pros and cons of such data

⁸ <https://www.enisa.europa.eu/topics/data-protection/privacy-by-design>

analysis in terms of the scale of the benefits that could be derived and the associated cost of such data analysis.

A final stage is using the analysed data to support decision making. Again farmers may benefit from the support of a farm advisor in understanding how data analysis can support decision making at the farm level.

In terms of practice adoption, some farmers may be more convinced by evidence for the suitability of a technology or a farm management practice if it is derived from the analysis of data from real farms, rather than data from research farms. This presents a further justification for the analysis of data from “real” farms, since it may contribute positively to technology adoption rates.

3.6. Creating awareness about current and future benefits of data sharing

A greater understanding of current policy in agriculture and potential future policy developments should help to make farmers aware of the benefits of having as much detail as possible available to them in respect of their farm. Such data, especially if it is collected over time, can be extremely valuable as a means of demonstrating progress being achieved on farm, particularly in the context of the emerging agricultural sustainability agenda and the immediate challenges presented for agriculture by the climate, environmental and human health ambitions within the European Green Deal and the EU Farm to Fork Strategy.

Continued awareness amongst farmers and other stakeholders of the need to demonstrate progress with regard to technology adoption and improved farm management practices is crucial. Clearly, evidence of such advancements, with reference to data collected on farms and elsewhere, will be increasingly important in comprehensive sustainability assessments. Indeed, meaningful interaction with farmers and their intermediaries may result in the exchange of ideas and advice on how best to collect relevant data and design appropriate metrics. As an example, the Monitoring, Verification and Reporting (MVR) process used in the estimation of a country’s territorial GHG emissions, requires considerable data to demonstrate changes in activity and farm management practices which reduce agricultural emissions. Such data can also be used to make verifiable claims in respect to the credentials of agricultural outputs produced on EU farms. This data can be useful for marketing purposes and has the potential to allow farmers differentiate their output from output that has inferior environmental credentials. This can then facilitate a market for superior farm outputs that has been produced in a way that is more sustainable, enabling farmers to achieve higher prices for such output.

The recent introduction of the EU taxonomy classification system, establishing a list of environmentally sustainable economic activities, will be most beneficial in assisting sustainable investment and the implementation of the European Green Deal.⁹ The Taxonomy Regulation establishes six environmental objectives as listed below:

⁹ https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

1. Climate change mitigation
2. Climate change adaptation
3. The sustainable use and protection of water and marine resources
4. The transition to a circular economy
5. Pollution prevention and control
6. The protection and restoration of biodiversity and ecosystems

4. Projects harnessing the benefits of data integration

A number of existing projects are exploring the potential for data integration and the benefits that it could provide. These projects are summarised here.

BESTMAP <http://bestmap.eu/>

Behavioural, Ecological and Socio-Economic Tools for Modelling Agricultural Policy

In the evaluation of how well the new CAP is meeting its objectives, progress in dealing with diverse challenges such as climate change, land-use intensification and land abandonment must be considered. Given the CAP's new delivery model and the requirement for the design of Strategic Plans there is scope to better understand the trade-off between environmental and economic sustainability at the farm level. Existing impact assessment models do not appropriately address the complexity of decisions made by farmers and ignore the wider impacts of policy on natural, social and cultural assets in rural areas. To this end, the BESTMAP project aims to develop a new flexible, interoperable and customisable framework that will take account of farmers' needs and effectively monitor policy impacts on natural, social and cultural assets in rural areas. The newly developed framework will be implemented in five regions across Europe, holding diverse agricultural, socio-economic and political backgrounds.

Ziv et al. (2020) outline that the BESTMAP project aims to:

- Develop a behavioural theoretical modelling framework to take into account complexity of farmers' decision-making;
- Develop, adapt and customise a suite of open source, flexible, interoperable and customisable computer models linked to existing data e.g. LPIS/IACS and remote sensing e.g. Sentinel-2;
- Link economic, individual-farm agent-based, biophysical ecosystem services and biodiversity and geostatistical socio-economic models;
- Produce a simple-to-use dashboard to compare scenarios of Agri-Environmental Schemes adoption;
- Improve the effectiveness of future EU rural policies' design, monitoring and implementation.

Demographic, behavioural characteristics and socio-economic data will be collected using semi-structured interviews at case study level. Based on this information on farmer behaviour, BESTMAP will set up agent-based models for each case study, capturing the decision making process of farmers associated with the adoption of agri-environmental schemes.

To date, Will et al., (2021) have synthesised four key factors for successful modelling for policy and management support in systems that incorporate both social and environmental components. These are:

- the specific requirements caused by modelling the human dimension;
- the importance of data availability and accessibility;
- essential elements of the partnership between modellers and decision-makers; and
- insights related to characteristics of the decision process.

A simple-to-use web-tool will also be developed, helping policymakers to analyse the adoption of various agri-environmental schemes, and assist in the modelling of impacts at a regional and national level.

MIND STEP <https://mind-step.eu/>

Modelling Individual Decisions to Support the European Policies related to agriculture

The wider scope of the new CAP and the need to measure impact at the farm level (particularly with regard to the environment and ecosystem services) requires the development of a suite of impact assessment tools.

The MIND STEP project aims to support public decision making in agricultural, rural, environmental and climate policies taking into account the behaviour of individual decision-making (IDM) units. Current state-of-the-art agricultural models are not capable of taking account of individual farm and local effects as they are specified at higher levels of aggregation. The MIND STEP project aims to improve exploitation of available agricultural and biophysical data and will include the IDM unit in policy models (Helming et al., 2019).

Specifically, the project aims to:

- develop a highly modular and customisable suite of IDM models, focussing on the behaviour of individual agents in the agricultural sector to better analyse the impacts of policies;
- develop linkages between the new IDM models and current models used at the European Commission to improve the consistency and to broaden the scope of the policy analysis;
- develop an integrated data framework to support analysis and monitoring of policies related to agriculture;
- apply the MIND STEP model toolbox to analyse regional and national policies and selected EU CAP reform options and global events affecting the IDM farming unit, working together with policymakers, farmers and other stakeholders;
- safeguard the governance and future exploitation of the MIND STEP model toolbox.

MIND STEP is based on the idea that the optimal agricultural model would be a bottom-up, interlinked system of micro or individual models describing behaviour. These would be combined in the MIND STEP model toolbox to assist policy makers in making better decisions in the design, monitoring and evaluation of policies (Helming et al., 2019).

AGRIMODELS <https://agrimodels-cluster.eu/>

The MIND STEP, BESTMAP and another project Agricore, have come together to form the AGRIMODELS cluster in order to co-ordinate the potential synergies in their research to increase the modelling capabilities in the agricultural sector.

SUPREMA <https://www.suprema-project.eu/>

Support for Policy Relevant Modelling of Agriculture

The SUPREMA project is expected to increase and improve the capacity of existing agricultural models. It is a meta-platform for agricultural modelling supported by three main pillars (needs, tools and testing). SUPREMA is based on a stakeholder foundation to bridge the gap between the expectations of policy makers and the capacity of models to deliver relevant policy analysis addressing societal challenges faced by European agriculture (Jongeneel et al., 2020).

The project had four specific objectives:

- A SUPREMA roadmap of future directions for modelling was developed. The need to improve the capacity of current models or a linked system of models to deliver on an increasing variety of policy objectives was assessed.
- An enhanced and strengthened SUPREMA model family was created. The performance and capacity of current tools, individually and as a linked system, was enhanced in a few focus areas for integrating new policy challenges (e.g. climate change, SDGs, supply chains). The capacity of the modelling network has been strengthened by an enhanced infrastructure for database improvements and model interaction, strengthening existing and establishing new linkages among models, targeted technical improvements and consolidation activities (i.e. model testing and versioning).
- Future directions of modelling in agriculture were explored and tested through scenario applications involving the SUPREMA models in a coordinated fashion. This testing enables a better understanding of the functioning of the SUPREMA model family and the EU agricultural sector at different spatial scales (e.g. European, national, regional and farm level) for different applications. A number of case studies were implemented to showcase the potential and limitations of the model suite to represent different scales of agriculture, various agricultural activities, different aspects of upstream and

downstream sectors, bilateral trade and multiple policies affecting agriculture directly or indirectly.

- A SUPREMA meta-platform was established, to share and discuss the findings of the work with existing model platforms, research communities, and policy makers.

The models included in SUPREMA (IFM-CAP, CAPRI, AGMEMOD, MITERRA, GOBIOM, MAGNET) cover different spatial scales of analysis (grid, farm types, regional, national, European and global), various agricultural activities (e.g. arable crops, livestock, horticulture), representations of technologies, but also different aspects of its market environment (linkages to upstream and downstream sectors and bilateral trade) as well as multiple policies affecting agriculture directly or indirectly.

Research from the project concluded that there is an urgent need for integrated model use in view of the complexity of the assessments that are required for the new CAP. The project highlighted a number of challenges that will require solutions to better serve policy makers in their future policy design.

NIVA <https://www.niva4cap.eu/>

New IACS Vision in Action

Another initiative exploring innovation in the use of administrative data is the NIVA project. The overall objective of the project is to modernise IACS by making efficient use of digital solutions and e-tools, by creating reliable methodologies and harmonised data sets for monitoring agricultural performance, while reducing the administrative burden for farmers, paying agencies and other stakeholders.

NIVA delivers a suite of digital solutions, e-tools and good practices for e-governance and initiates an innovation ecosystem to support further development of IACS which will facilitate data and information flows. The project's results promote a transparent, simpler administrative process that contributes to a future CAP which can increase environmental performance.

The NIVA project starts from the premise that innovative new IACS developments responding to new digital trends can lead to more sustainable agricultural production across MS and can assist in a reduction of the administrative burden to actors and stakeholders. This involves three main challenges:

- absorbing innovations to simplify governance;
- reducing the socio-economic and administrative burden to farmers; and
- reducing the gap between IACS data use and potential broader uses.

FaST <https://fastplatform.eu/>

Farm Sustainability Tool

The FaST digital service platform aims to facilitate the generation and re-use of solutions for sustainable and competitive agriculture based on space data (Copernicus and Galileo). The platform, which is supported by the EU Commission's DG Agriculture and Rural Development, the EU Space Programme (DG DEFIS) and the EU ISA² Programme (DG DIGIT) is currently being used across a number of participating regions within the EU. The initiative allows for data integration and interoperability, facilitates efficient data sharing and the re-use of IT systems. It has a number of key aims:

- to support farmers in their administrative decision making processes to address farm profitability and environmental sustainability;
- to provide a reliable on-farm landing spot for digital solution developers (including satellite-based solutions) and service providers;
- to reduce the administrative burdens for farmers and paying agencies.

The modular platform will support the CAP by enabling the use of solutions based on machine learning applied to image recognition, as well as the use and reuse of IoT data, various public sector data and user generated data.

CAP Indicator Dashboard

https://agridata.ec.europa.eu/extensions/DataPortal/cmef_indicators.html

In order to increase transparency and facilitate policy evaluation through the summation of a broad range of data collected, the 'CAP Indicator Dashboard' was developed by DG AGRI. The dashboard is interactive, with data on different levels (output, results, context and impact indicators) combined to allow for visualisation by specific topics. It compiles different databases, including those from Pillar I and II of the CAP and is specified across nine themes. Data can be filtered and viewed at the EU level as well as by individual MS level for different years.

5. Conclusions

The CAP NDM aims to streamline governance, improve delivery and decrease bureaucracy and the administrative burden (European Commission, 2018c). Given increased autonomy, MS will be directly responsible for scheme design, implementation and evaluation, making it possible to better take account of local conditions and needs. Oversight of the new CAP through the NDM will move from a compliance to a performance based approach through the PMEF. From a budgetary perspective, the new approach will allow paying agencies and certification bodies more freedom in managing the compliance and control systems in place (including penalties), within a more general set of rules at EU level. Following a budgeting strategy focussed on results and performance-oriented payments, the new framework links the eligibility of payments to actual delivery on the ground. Performance is therefore at the heart of the new financial management and assurance model (McEldowney and Kelly, 2019).

The requirement for each MS to draw up a NSP is central to the new performance-based delivery model. Such plans set out the MS assessment of needs, the specific CAP objectives it intends to address, its intervention strategy including the quantitative targets it intends to achieve with respect to these objectives, and the interventions it plans to use. The financial plan, and monitoring and evaluation procedures proposed are also included and MS are required to set target values and benchmarks for all common and specific indicators. The PMEF requires MS to submit an annual performance report to show progress towards the targets in the form of output, result and impact indicators. In assessing MS performance the Commission will undertake an annual performance clearance and review and an interim evaluation in addition to an ex-post evaluation which will also involve the MS itself. The key shift in the delivery and evaluation of the new CAP across individual MS relates to their ability to set specific objectives and targets. There exists some concern that some MS may chose not to be overly ambitious in setting goals, due to their desire to ensure successful delivery. Therefore, although specified outcomes may indeed be achieved in an individual MS, overall progress may be relatively less than in other MS where higher targets may have been set.

Although simplification and modernisation were the two over-arching objectives of the Commission's CAP proposals, some have concluded that the strategic planning approach will result in a substantially greater administrative burden at the MS level (Matthews, 2018, Carey, 2019 and Erjavec et al., 2020). Others contend that given the increased organisational effort required on the part of MS (especially where a regionalised model is present) the approach may indeed be overly complex (Cagliero et al., 2021 and García Azcárate and Folkeson, 2020). According to Erjavec et al. (2018), the NDM provides some prospects for simplification, but given an inherently unchanged governance system (Jongeneel et al., 2019), the key question is therefore how the proposed NSPs will be applied in the real world and whether or not they will deliver a more effective policy.

The absence of a "level playing field" across MS has also been raised. For some the move to a strategically oriented and performance-based policy may represent a considerable planning and implementation challenge and require substantial effort in the upgrading of strategic, analytical and administrative capacities and procedures. This may result in some MS

demonstrating limited policy ambition in order to satisfy result-based targets. This may particularly be the case in the design of multi-faceted or multi-annual interventions or where some MS are less technologically advanced than others in the adoption of monitoring and evaluation tools.

Overall, Erjavec et al. (2020) conclude that the period 2023-2027 is a period of learning, in which the quality of data sources must be significantly increased, with systematic monitoring of the measures and their effects. To this end, they have identified roles for both MS and EU bodies such as the Joint Research Centre (JRC) European Environment Agency (EEA) and Eurostat. Similarly, a key role for the increased use of IACS data has also been identified.

Multiple sources of agricultural data now exist. A number of projects have already begun to explore the potential for data aggregation and the additional value this can bring for data users, be they policy maker, farmers or consumers. However, there are obstacles to the integration of such data. Although, technological developments in data collection, data management and data processing are taking place legal issues relating to data ownership, certification and commercial secrecy, amongst others remain and will need to be overcome. These developments make the possibility of collecting larger amounts of data both technically and economically feasible. This can deliver benefits for administrators, farmers and policymakers.

A lack of trust between farmers and data collectors needs to be addressed and overcome. Users of farm data need to approach the issue of data sharing in a way that returns benefits to farmers. Farmers themselves need to better understand the value which the analysis of such data can deliver to them through the facilitation of better farm management decisions. There is a role for farm advisory in demonstrating the value of such data to farmers. The ultimate benefit is derived when various data sources are merged to maximise the amount of information available for the individual farm, individual field or even a part of a field. On the other hand, the upscaling of such data facilitates territorial benchmarking and strategic planning and investment. Certainly, further benefits are derived by the pooling of data from multiple farms to facilitate more comprehensive analysis.

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