Geodata for M&E in FNS Projects

Summary report and a roadmap to greater adoption

G4AW
GEODATA FOR AGRICULTURE AND WATER

Netherlands Space Office

bop inc

Table of Contents

1 Introduction

1. Introduction

Background

Geodata has the potential to be transformational in how we do monitoring and evaluation (M&E) in development work. Geodata and remote sensing can help us to do M&E at a lower cost, with quicker turnaround-times and a far lower burden on project participants than more traditional M&E approaches. It will also be possible to perform post-project analyses several years after projects have ended. This is especially true for assessing changes to land use patterns, agricultural activity and some environmental changes. And through proxies we can leverage geodata to monitor some changes in household wealth, dietary diversity and food security.

This report summarises our exploration into how geodata can contribute to M&E in development work, especially the new Food and Nutrition Security (FNS) goals and indicators formulated by the Dutch Ministry of Foreign Affairs (MFA). The FNS indicators are developed in a way that can help track the progress towards SDG-based Dutch policy goals for 2030 with robust evidence. Our exploration draws on the experience of the Geodata for Agriculture and Water programme (G4AW) of the Netherlands Space Office (NSO).

Since 2013, G4AW has worked on improving food security in developing countries by promoting the creation of digital advisory services that leverage geodata. With G4AW coming to a close, this is an opportune time to consider how geodata can inform M&E in a future donor programme similar to G4AW, that must align with the goals and indicators of the new FNS framework.

The report therefore addresses two key questions-

- How might future digital programmes improve upon the current M&E system and incorporate the FNS results framework?
- In what ways the future digital programmes can use geodata in monitoring and evaluation of FNS indicators?

The first question is explored in Chapter 2 and Chapter 3, while the second question is addressed in Chapter 4. The fifth and final chapter briefly presents a roadmap for adoption of geodata into M&E processes across programmes and projects supporting FNS goals in the development sector.

Methods

This report is the result of background research on these topics and results of a multi-disciplinary in-person workshop held in Amersfoort on September 5th, 2023. The background research comprised desk-based review of the existing indicator guide, methodological notes or relevant documents related to the existing G4AW programme and the FNS results framework, paired with informal background expert interviews.

Background research was also conducted through a literature review of opportunities and challenges of using geodata in M&E, and the recently developed impact measurement guide for agri-tech services by Bopinc and the Netherlands Food Partnership through the Digital Agrifood Collective (DAC). The background research generated four background briefs which were shared with the workshop participants so that all would have a common basis of knowledge for the topics under discussion.

The workshop was organised with the aim of collaboratively exploring the application of geodata in M&E of FNS projects with digital service components, while addressing the alignment with the FNS results framework. The workshop brought together 36 experts drawn from geodata providers, NGOs and government, all engaged in some way in projects contributing to FNS and using - or wishing to use - geodata to inform the M&E for these projects. This interactive workshop allowed these participants to exchange best practices, share new developments, and deliberate on some of the questions arising from the background briefs.

2 M&E in G4AW

2. M&E in G4AW

G4AW is a programme of the Dutch MFA, executed by NSO, focused on the policy priorities of food security and water. G4AW advances food security by empowering farmers and (agro-) pastoralists with the information about good agricultural practices, climate, weather, market information and risk factors to help them produce food sustainably and efficiently.

G4AW strikes partnerships with digital service providers, satellite data/service operators, the private (agricultural) sector and transmission operators as well as public organisations, NGOs, extension departments, research institutes, farmer cooperatives. The G4AW programme funds public-private partnership projects that offer demand-driven and financially sustainable services and products for agricultural purposes using open and free satellite data.

These services include but are not limited to weather forecasts, pest and disease warnings, drought and flood warnings, and risk profiling for micro-insurance. Read more about the current G4AW programme here.

The G4AW M&E framework calls for reporting on indicators at the input, activity, output, outcome and impact levels, as summarised in the table below.

Table 1: G4AW M&E Framework Reporting, Definitions and Indicators

Mandatory "sheets"	Definitions	Key Activities and Indicators
Input	The financial, human, and material resources invested in the programme or intervention.	- Knowledge and know-how - Project budget
Activity	Actions undertaken within the programme to produce the intended outputs, outcomes, and impacts.	- Develop business case - Develop partnership - Set up information service (implement, operate, maintain - Transfer knowledge and know-how - Report to G4AW
Output	The direct products or deliverables resulting from programme activities.	- Information service is operational, end-users are being reached, food producers are trained
Outcome	The short-term and medium-term effects of programme outputs.	- Improved food production - Improved efficiency of inputs (water, fertiliser, seeds, pesticides, etc.) - Improved income security
Impact	Impacts represent the long-term and cumulative effects of programmes or interventions over time.	- Changes in poverty alleviation - Changes in sustainable growth - Changes in self-reliance

During the application process, potential project partners must identify the indicators they will report on in the baseline study, annual reports, final report and evaluations. While some indicators are mandatory for reporting, others can be added based on the project's specific outputs and outcomes.

The G4AW M&E framework has undergone different updates to align with emerging insights and new donor requirements. The most a significant revision emphasized digital inclusion, particularly regarding gender and youth.

For projects that were already in the execution phase, workshops encouraged the adoption of these additional indicators. This remained on a voluntary basis, because these new indicators had not been initially included in the project proposal or the baseline survey. The number of mandatory indicators have thus expanded during the G4AW program, with an increased focus on assessing the outreach to diverse user groups.

Opportunities

The G4AW M&E framework offers an opportunity for partners to measure the annual reach of farmers and other food producers participating in G4AW services, track training outcomes, and identify the number of producers experiencing improved livelihoods. It also allows for monitoring the percentage of women and youth engaged in the programme, highlighting the positive impact on gender and age inclusivity.

Having a standardised sex and age-disaggregated framework for data collection provides additional benefits to project evaluations. Projects under G4AW gain valuable insights into diverse gender and age groups, enabling targeted interventions, identifying disparities, promoting equality, and assessing differential impacts. This knowledge drives accurate reporting and strategy refinement to maximise positive impact and foster inclusive agricultural development.

Challenges

Monitoring and evaluating within the G4AW program has encountered several significant challenges in generating clear insights at both outcome and impact levels and in ensuring comparability between projects. Some of the key challenges include:

Limited reporting at outcome and impact levels: Most reporting in the G4AW programme thus far has been for outputs and some outcomes. Reporting has been limited for most outcomes and impacts. Without comprehensive data at output and at impact levels, it has been a challenge for the programme to get an accurate picture of whether it is contributing to its goals of promoting sustainable, efficient food production and greater food security.

Impact (input reduction, output increase) has sometimes been covered by evaluation of the created demo plots, in which benefits of the recommended (good agricultural) practices has been monitored. Scaling demo-plot performance to programme-wide impacts remains challenging. Good understanding of the different aspects of sustainable land management have also been missing from the framework. The main focus was only focused on two elements: 1) decrease in use of inputs; and 2) increase in the efficiency of water use.

Limited use of digital tools for M&E. While digital tools where created, only few have included two-way communication or other ways to use the same tools to get feedback from users. The focus of most of the tools was to provide advice, and generally not to collect information. Part of this limited use of two-way communication might be related to some technical challenges (unfamiliarity), but this is also related to a lack of clear understanding of the benefits and acceptance of possible feedback from smallholders.

The endline evaluation of G4AW has also integrated a "spatial approach" for monitoring and evaluating specific projects within the program. However, establishing a widespread accepted digital approach to M&E has proven challenging, primarily due to the only recent emerging scientific foundation. Despite the potential benefits, the adoption of digital methods, such as two-way communication or spatial analyses, for evaluating the impact of digital advisory services remains limited. If there's a lack of trust in the benefits of digital tools, it also becomes challenging to recognize the M&E potential they can offer.

Nevertheless, the distinct characteristics of digital M&E tools, particularly their ability to match the reach and scale of digital advisory services, necessitate the use of such tools. Digital approaches, such as utilizing two-way communication for surveys and employing spatial methodologies to assess the impact on specific land-use indicators, are ideally positioned to meet these demands.

Lack of standardisation of indicators used: Common definitions have been lacking, even for relatively simple metrics like the number of active users of a digital service. Concerns about the comparability of these data persist, especially at the outcome and impact levels. A related challenge is that most M&E data is self-reported by partners, sometimes drawing on different data collection methods and definitions, even for the same indicators. Lack of standardisation is not only based on common definitions, but also by the difficulties to compare different service delivery methods (e.g. radio vs. smartphone) and objectives.

Initiatives supported through the G4AW programme shared using geodata for smallholders as a common element, but with a wide range of applications with differing objectives. Some reached livelihood improvement by reducing conflicts and livestock mortality, some focused on better protecting/insuring farmers from climatic shocks, while others focused on increase of crop production. The differences in Theory-of-Change (ToC) result in a different interpretation of the relevant indicators.

Focus on quantitative data, at the expense of qualitative: Current frameworks have prioritised quantitative data, resulting in a lack of qualitative information about users of these services, their perceptions of the services and the effects the services have for them. Quantitative data has a lot of benefits, such as comparability between projects and programs, finding trends in time, and relative easy collection of data. Quantitative data can also be linked to policy objectives, which generally include objectives about the number of people that have benefited from interventions and certain percentages increase in income, productivity and other relevant indicators.

At the same time, this focus on quantitative data results in a lack of compelling narratives and rich, detailed information that matches the diversity in the Theory-of-Change in projects. Qualitative data can be used to complement the quantitative data collected. Limited use of qualitative data results in a limited view of the outcomes and impacts of the programme. This is especially the case as projects focused on digital tools often find challenges when it comes to the digital readiness. Some projects need to focus a lot on strengthening the enabling framework ('opening new markets'), which cannot be measured with quantitative indicators.

The lack of contextual insights and stories further hinders a comprehensive assessment of project activities and their true impact. Qualitative data (surveys on needs, actionability, satisfaction) have been crucial input in the design and improvement of the created digital services (user-centred design). This, however, has not yet been translated to the M&E framework of G4AW.

Recommendations for Overcoming Challenges and Enhancing the M&E Process

Integration of Qualitative Data: The experts in the workshop highlighted the need to enhance the comprehensiveness of data by integrating qualitative information, such as participant testimonials, images and videos, into the monitoring and evaluation process. Qualitative information can provide valuable context and insights that quantitative data alone may not capture. Qualitative methods like Contribution Analysis and Most Significant Change may also help establish attribution for project impacts.

Additionally, conducting field visits and engaging with local communities can help gather qualitative data, allowing for a deeper understanding of the socio-economic and cultural factors that influence FNS indicators. A primary reason for the lack of qualitative data collected in G4AW and similar programmes is the preference (need) among donors for quantitative M&E data, and the perception among development practitioners that collecting quantitative data from and about users is easier than qualitative. Though that may be true in many cases, quantitative data alone rarely paints a complete picture, especially of how and why change happens.

Combining Training and Feedback Sessions: The recommendation to combine training sessions with feedback sessions underscores the importance of fostering a dynamic and iterative approach to capacity building. By integrating feedback mechanisms into training programmes, project implementers can assess the effectiveness of their interventions in real-time, make necessary adjustments, and ensure that training initiatives are responsive to the evolving needs of small-scale food producers.

Use Harmonised Definitions and Measurement Approaches: There are many potential benefits to harmonising the indicators used and methods used to measure them across projects and programmes. This will enable accurate comparisons between cases and over time, and should increase the confidence that donors and other stakeholders have in digital M&E data.

Workshop participants were enthusiastic about the DAC impact measurement tool, which starts by proposing simple definitions of common terms in projects working with digital tools like 'active users' and 'user satisfaction' for the same types of services. The DAC impact measurement tool goes further to also propose common definitions and measurement approaches for the outcomes and impacts of using digital services on smallholder farmers and other target groups.

3 Incorporating FNS Results into M&E for Future Programmes

3. Incorporating FNS Results into M&E for Future Programmes

How closely does the FNS framework match-up to the indicators used for M&E in the current G4AW programme? And how might future donor programmes align fully with FNS? This chapter presents a comparison of indicators used by the G4AW programme against the FNS results framework launched in 2022. Here we also briefly present the commonalities and differences in definitions and measurement methods of the indicators between these two frameworks. The challenges associated with integrating the FNS methodology into future digital programmes is also discussed. Finally, we offer broad recommendations encompassing the integration of FNS indicators, along with specific guidance related to the challenges at hand, drawing on desk research as well as expert input from the workshop.

Overview of the FNS Results Framework

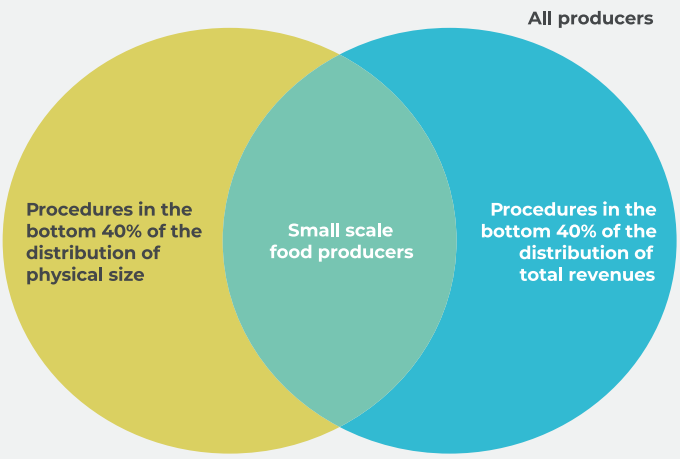
The FNS results framework of 2022 comprises indicators at the output and outcome levels to track the progress towards the following SDG-based Dutch policy goals for 2030:

"...end malnutrition for 32 million people, particularly children;
double the productivity and income of 8 million small-scale food producers;
achieve ecologically sustainable use of 8 million hectares of farmland."

The FNS indicators fall into three results areas; **nutrition, farming/agricultural performance,** and **sustainable land use**. The FNS guide aligns indicator definitions with SDG Targets. For example, the FNS guide uses the term ''small-scale food producers' (SSFPs)" used also in SDG Target 2.3: "by 2030 double the agricultural productivity and the incomes of small-scale food producers..."
The existing G4AW Framework indicators primarily contribute to the **farming/agricultural performance** result area and to some extent, the **sustainable land use** result area. Also, the G4AW M&E framework has a business-oriented approach, and includes indicators that are important from a commercial perspective (e.g., use of service, customer satisfaction, business case). These fall outside of the scope of the FNS outputs and outcomes, although they remain important indicators of the ways that digital service providers supported by G4AW contribute to improved farming and agriculture performance.

Opportunities

Integrating FNS definition of the target group in future programmes: All FNS output and outcome indicators related to farming/agricultural performance focus on 'small-scale food producers' as the target group. The FNS guide adopts the UN FAO definition of small-scale food producers. This rather technical definition is based on two considerations: the physical size of land under cultivation or amount of livestock owned, and the economic value of revenue from agricultural activities.



Source: Kvistgaard et al. 2020

In both cases, it's the point where an food producer falls in her or his national distribution of land access or revenue that determines whether they are considered 'small-scale'. Those falling in the bottom 40% of the national distribution of land access and the bottom 40% of the distribution of economic revenues from agriculture are considered 'small-scale food producers'. The graphic on page 11 summarises this visually.

The current G4AW M&E framework uses the term 'food producers' with no disaggregated data for 'small-scale food producers'. Hence, there is an opportunity to include reporting on this group in future programmes to better contribute to the SDGs and the Dutch policy targets. The challenge in doing so is to ensure the collection of farmer-level data on farm size (area of land, number of livestocks), and annual farm revenue.

Additionally, future programmes could also explore if small-scale food producers can be further segmented to provide tailored services to their needs. For instance, IDH has developed the Farmfit Segmentation Tool that categorises smallholders into three groups - subsistence farmers, commercial farmers, and diversified farmers. The categorisation draws on eight data points which include the ratio of agricultural income to total household income, total land size, sufficient water for farming activities, types of buyers, presence of contract with the buyer, types of labour used on farm, intention to relocate to urban areas and presence of commercial livestock. The farm level data on farm size (land area and number of livestock), and annual farm revenue are critical to report on Dutch Policy targets, and additional data points can help further segment the small-scale producers to provide tailored services.

Integrating FNS output and outcome indicators into future programmemes:
Within the three result areas of FNS, the current G4AW Framework indicators predominantly align with the **farming/agricultural** performance result area, and to a limited extent, with the **sustainable land use** result area. However, there was little overlap with the nutrition result area.

Given that farming/agricultural performance and sustainable land use are the two areas of convergence between these two frameworks, an in-depth comparison of similar indicators is provided in the tables below (Table 2 on outputs, and Table 3 on outcome)**.** The first two columns provide details on similar indicators, including their definitions and methodologies. The third column highlights the potential for harmonisation, indicating opportunities to integrate these indicators into the M&E framework of future programmes similar to G4AW.

Table 2: Comparing G4AW outputs indicators against those in the FNS Farming/agricultural performance result area

FNS Results Framework	Existing G4AW M&E Framework	Opportunity for integration
OUTPUT		
B.2.1. Number of SSFPs directly reached with activities aimed at **structural/ systemic improvement** of their agricultural performance This indicator counts the SSFPs targeted directly **structural/ systematic** agricultural performance improvement interventions. Structural/systemic improvement might happen when interventions cover 'multiple aspects of agricultural performance (inputs, farming techniques, market potential) and/or there is regular follow-up'	N/A	No indicator in the current G4AW framework provides data on FNS output B.2.1 on structural/systemic improvement. This FNS indicator is relevant when farmers receive integrated support covering multiple aspects of agricultural performance or regular follow-ups for a longer period. Future programmes need to scope whether subsidy recipients will receive such integrated support and whether the M&E framework needs to integrate this output indicator.
B.2.2 Number of SSFPs directly reached with activities aimed at **temporary/partial improvement** of their agricultural performance. This output indicator counts the SSFPs reached directly with targeted interventions. Here, the interventions are not supposed to be integrated, and can only be deemed to temporarily and/or partially benefit the agricultural performance of the SSFPs. Examples include- '(targeted) distribution of inputs such as seeds or fertiliser, providing access to weather information to specific farmers'.	3a. Total number of people that have received **direct training or education** within the project The reach might happen via train-the-trainer, one-on-one training by these trainers, workshop attendance, or e-learning.	Training or education about a digital service to farmers does not encompass holistic and integrated interventions to improve farmers' agricultural performance. Therefore, this G4AW indicator is more aligned with the FNS output on 'temporary/ partial improvement' than the 'structural/systematic improvement' (mentioned in the row above). However, the G4AW output indicator should measure the reach specifically for food producers instead of people in general.
B.2.3 Number of small-scale food producers **indirectly** reached This output indicator counts the SSFPs reached in a non-targeted way. Non-targeted reach means people who are reached are not and cannot be identified. Examples of non-targeted interventions include- seed banks, mass media campaigns.	1a Total number of food producers that have been reached by services provided within the project This output indicator counts food producers reached with direct training and indirect education.	Both indicators are similar in nature - covering the indirect/non-targeted interventions.

Table 3: Comparing G4AW outcome indicators against those in the FNS Farming/agricultural performance result area

FNS Results Framework	Existing G4AW M&E Framework	Opportunity for integration
OUTCOME		
B.1.1. Number of small scale food producers who progressively realise a **living income**. The (**gross**) **income** is measured by deducting the operating costs of production from revenues. Moreover, to be reported under this indicator, the SSFPs should experience **at least 10%** income increase from the baseline attributable to the intervention.	13.a. Number of food producers with **increased income** as a result of using the service(s) provided within the project - Total The method of measurement is kept open.	The FNS and G4AW indicators on income and yield are conceptually similar. However, the FNS methodology offers a **detailed guide** on calculating farm income and yield increase which can be adopted in the M&E framework of future programmes similar to G4AW.
B.1.2. Number of small scale food producers who progressively decrease **the yield gap**. This indicator outcome indicator counts the number of SSFPs who structurally raise their average crop yield towards the potential yield, thus diminishing the yield gap. Practically, the indicator requires comparing changes in yields of farmers from the baseline through household surveys or other methods. To be reported under this outcome indicator, SSSPs should experience at least 20% yield increase from the baseline attributable to the intervention. Upon availability of regional potential yields and/or yield gaps, additional reporting on the % decrease in yield gap is suggested.	10. Improvement of **food production** (crop yield increase in kg/ha and %) as a result of using the service(s) provided within the project The method of measurement is kept open.	
B.1.3. Number of female small scale food producers who become **progressively empowered** Empowerment is defined as 'the degree of freedom people have to control and have positive impacts on their lives and futures'. FNS guide proposes quantitative indexes such as Pro-WEAI developed by IFPRI (a.o). It also allows qualitative methods for contribution analysis if such an index measurement is not feasible.	27. Progress made on gender equality and empowerment of women, girls and youth. It's a qualitative indicator. Subsidy recipients need to describe contribution to women's and young people's position in terms of land tenure, ability to access the information/technology, credit, ownership of mobile phones, decision-making power, etc.	Future programmes can explore the feasibility and relevance of the **quantitative indexes** as proposed by the FNS guide for empowerment and resilience related outcomes.
B.1.4. Number of small scale food producers whose **livelihood** became more **resilient** to **shocks** 'Resilience of food producers' (farmers') livelihoods to stresses and shocks refers to their capacity to resist, recover from, and/or adjust to disruptions and stresses that (may) adversely affect their livelihoods (e.g.climate/ environmental, economic and social shocks)'. The FNS guide proposes quantitative indexes like the Resilience Design and Monitoring Tool, and Multidimensional Poverty Assessment Tool (IFAD). If quantitative measure is not feasible, contribution analysis of the intervention should be measured.	30. Progress made on inclusive quality education and sustainable resilience and adaptive capacity to climate-related impacts It's a qualitative indicator. Subsidy recipients need to describe how the project and related services are contributing to the change in self-reliance and sustainable resilience and adaptive capacity to climate-related impacts.	Future programmes can explore the feasibility and relevance of the quantitative indexes as proposed by the FNS guide for empowerment and resilience related outcomes.

Table 4: Comparing G4AW outcome indicators against those in the FNS sustainable land use result area

FNS Results Framework	Existing G4AW M&E Framework	Opportunity for integration
OUTCOME		
C.1.1. Number of hectares of farmland under at least **2 conservation practices** The conservation practices are the farming methods and techniques that are not only efficient, but also reduce losses of land and water, safeguard natural resources, and promote biodiversity. The practices should follow main principles of "conservation agriculture- - minimal soil disturbance (e.g. no-tillage) permanent soil cover (e.g. crops - supplemented with organic matter) - crop diversification (e.g. through rotation or intercropping)." The FNS guide suggests using the Global Database on Sustainable Land Management (WOCAT) as reference to qualifying practices, but also allows for selecting locally appropriate conservation practices Results on this indicator can be assessed using various methods, such as surveys and field observations, and involves comparing the utilisation of conservation practices on the targeted hectares before and after implementing the intervention.	The current G4AW M&E indicators mainly focus on **efficient utilisation** of the resources and a reduction in use of inputs. The outcome indicators include the following- 11.a Number of food producers with reduced use of inputs as a result of using the service(s) - Total 12.a Improvement in effective use of water (%) as a result of using the service(s) provided within the project 12.b Improvement in effective use of seeds (%) as a result of using the service(s) provided within the project. 12.c Improvement in effective use of fertiliser (%) as a result of using the service(s) provided within the project 12.d Improvement in effective use of pesticides (%) as a result of using the service(s) provided within the project	The G4AW indicators are about **efficient resource** use which may contribute to conservation and agro-ecological resilience to some extent, but that is not the primary goal. The FNS guide sets clear definitions, qualifying practices, and indicators (direct and proxies) to measure them. Future programmes should explore whether digital services will have the potential to contribute to conservation and agro-ecological resilience, and to what extent. It is essential to conduct a comprehensive exploration to determine the alignment between the changes observed among service recipient farmers and the recommended practices. Additionally, the feasibility of adopting measurement methods (e.g., soil organic carbon) by digital service providers should also be thoroughly examined.
C.1.2. Number of hectares of **farmland** that **agro-ecologically** became more resilient to shocks The agro-ecological resilience is to be measured using proxy indicators such as soil organic carbon (SOC), habitat-species- and genetic diversity, etc. The FNS methodologies offer many resources on measuring these proxies, but acknowledges that it may not be feasible to measure these scientific indicators in all situations. If not feasible, the FNS guide suggests including survey questions to gauge farmers' own assessment of agro ecological resilience of their land (e.g. observations on soil quality, water retention capacity, etc.)	G4AW M&E does not specify which practices qualify as to reduce input usage, or which proxy indicators and measurement methods are to be used. The measurement process of these indicators is kept open.	

Challenges

FNS definitions of small-scale food producers: Adopting the FAO definition of small-scale food producers requires extensive farmer level data: size of the land, number of livestock and annual revenues from agricultural activities. Farmer level data is also important to track progress against FNS outcomes such as income and yield. Geodata-based solution providers collect location and plot delineation from the farmers to provide their services, and therefore, could potentially measure the size of the land, type of crops, and more (see more about the opportunities of geodata in the next section). However, one challenge that still remains is collecting the farm revenue data accurately, especially for those collaborating with intermediaries who use digital services to provide solutions to farmers.

FNS guidance on attributable income and yield increase: FNS methodologies on farming/agricultural performance recommend determining attributable income and yield increase using a control group study. For example, in the case of income increase, the FNS guide states that 'if both the target group and the control group have a 10% increase, attribution cannot be established'. While this methodology provides strong evidence on the outcomes, this might also be very technical and resource-intensive for G4AW and future programmes similar to it.

Recommendations to Integrate the FNS Framework

Broad Recommendations: Incorporating the FNS results framework into future programmes like G4AW will involve not only harmonising indicators and methodologies but also designing projects that lead to outcomes contributing to FNS objectives. For example, one aspect of the G4AW programme was to support digital services that contribute to greater efficiency in resource use (reduced use of inputs) by food producers. On the other hand, the FNS result area on sustainable land use aims to achieve greater conservation and agro-ecological resilience with specified qualifying practices and measurement methods. Hence, a future programme striving to align with the FNS results framework should first consider project designs that effectively contributes to all the FNS objectives.

The M&E framework for future programmes similar to G4AWs should have business-oriented indicators (e.g., active users, satisfaction) and generate qualitative learning for better service design. At the same time, the outputs and outcomes can be more aligned with the FNS framework, which provides detailed guidelines on methods and standardised quantitative indexes, enabling more meaningful comparisons of the impact of digital services on food producers.

Recommendations for effective farmer data collection: Collecting farmer level data (e.g., farm revenue, changes in revenue) are important not only for categorising farmers as 'small-scale food producers' groups but also to track progress towards FNS outcome. Expert recommendations on collecting some farmer-level data collection is given below:

Approach to collecting farmer-level data
To ensure farmers feel comfortable sharing their information, local lead farmers can be engaged in data collection. Lead farmers can help explain the purpose of the data in a language that farmers can easily understand. At the same time, it's important to clearly explain the purpose of the data and stress that data will be collected and used anonymously and confidentially so farmers will feel more willing to share their information.

Collecting data to targeting small-scale food producers
Farmers might easily be able to recall the size of the land and the number of different livestock they possess. The data then can be compared with the country level thresholds in terms of physical size of the farm (size of the farm and/or number of livestocks). For instance, as per the estimation by FAO, 40% of food producers in Bangladesh operate a land below 1 hectare. Therefore, a digital programme operating in Bangladesh can consider 1-hectare of farm land as the threshold for physical size of small-scale food producers.

For many countries the national level threshold might not be available. At the same time, collecting farmer level data on revenue and income might be more complex. In such situations, future programmes can explore indirect measures of farm revenue and income to measure whether the services are reaching farmers who are likely to be small-scale producers. Future programmes can explore whether household characteristics and material possessions can be used as income proxies.

One example of such a proxy is the Poverty Probability Index that estimates the likelihood that a household is below the poverty line. The PPI asks 10 questions about household characteristics and asset ownerships to compute whether a household is below the international and national poverty thresholds. By using a combination of direct and indirect measures, future programmes can have a more accurate targeting approach to reach small-scale producers.

- *Collecting Data to Monitor Agricultural Performance Improvement*

To understand the improvement in agricultural performance of small-scale food producers, relative questions can be asked, such as how small-scale producers see their current income/yield compared to the previous season. Asking indirect and relative questions has limitations in terms of quantifying the degree of change, yet this approach can still generate valuable data for continuous performance monitoring.

Moreover, integrating such questions into existing touch-points, like embedding them within digital apps or including them in interactions with extension agents and lead farmers, can be a relatively easier process. However, it is crucial to account for seasonality when determining the timing of data collection to ensure that the comparisons between two time periods are contextually relevant.

Recommendations to establish attribution: Measuring the improvement of income and yield attributable to the use of digital services by food producers can be quite challenging. Acknowledging the challenge, participants of the workshop proposed a range of methods to approach the issue of attribution.

- *Mapping the causal chain*

When analysing how digital services impact outcomes like farmers' income and crop yields, two critical factors need attention. First, it's essential to understand where digital services fit into the broader context of factors that influence farmers' income and yields. Even if a digital service is highly beneficial, it may not automatically lead to better income and yields as there might be contextually significant factors not in the sphere of control of the digital programme.

Second, the adoption funnel of digital services should be clarified, which includes the number of farmers reached, the number of farmers who register for the service, and those who actively use it. It is important to map the funnel while estimating the effects of digital services since the different groups of farmers may engage with digital services differently, with varying levels of intensity.

- *Impact Evaluation Design*

Experts recommended the use of experimental studies (i.e. Randomised Control Trials (RCT)) to generate the strongest evidence regarding attributable outcomes, and suggested contracting an independent M&E party for the evaluation exercises. Considering the difficulty in setting up a true control group, many experts also suggested alternative methods including time-series analysis showing change in trends from the point of intervention, comparing the changes in yield and income against a reference area, randomising the promotion of the digital services and qualitative approaches, described below.

- *Qualitative Evaluation*

Some experts also suggested qualitative methods of delineating the effects of digital services on food producers' agricultural performance. These methods include "Most Significant Change" and "Stories of Change," which delve into the mechanisms of change from the perspective of food producers themselves.

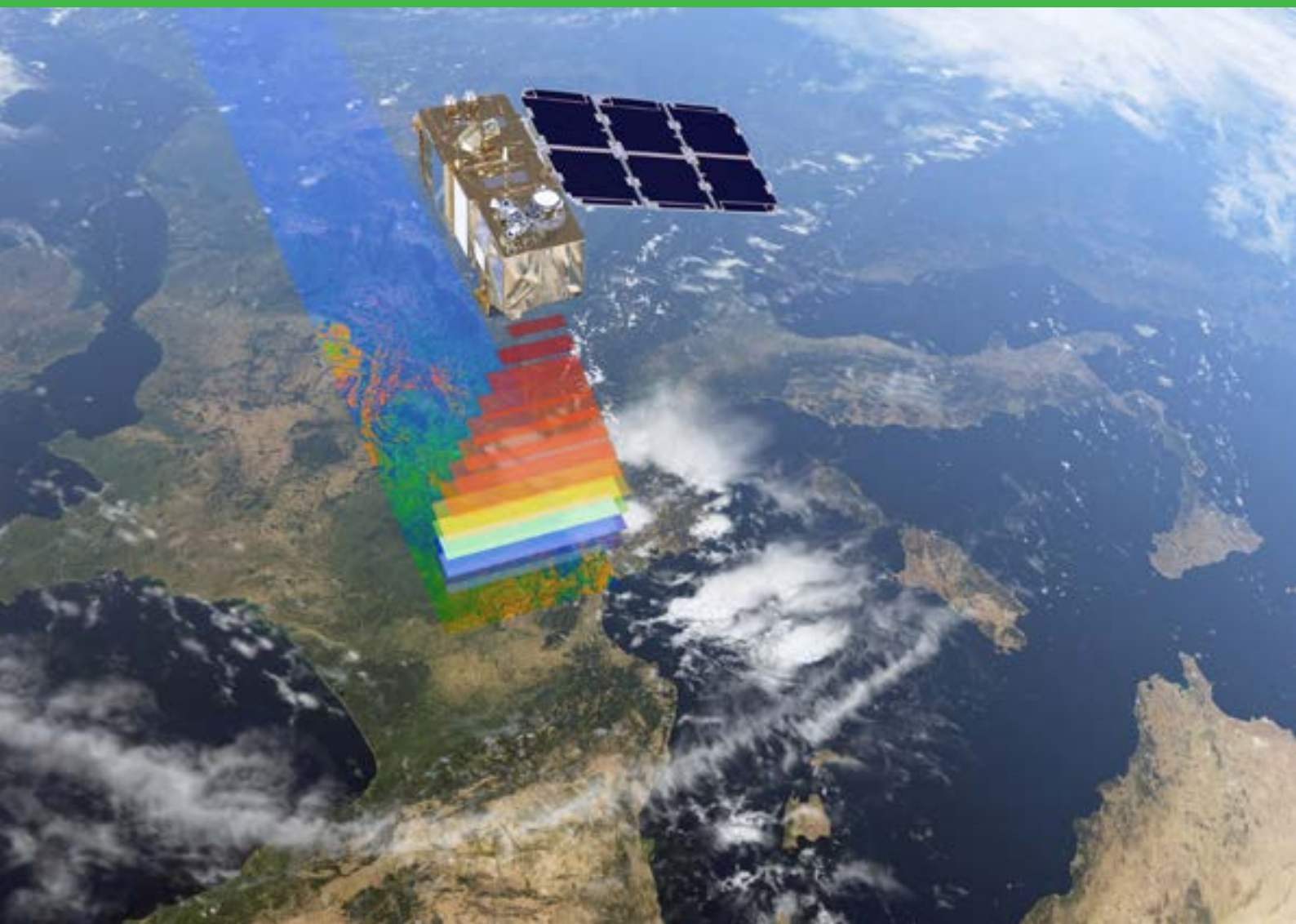
Qualitative data can also be used in combination with relatively simple "pre-post" studies when establishing control or comparison groups is too difficult. One such method is the Before and After Comparison with Opinion (BACO) in which the before and after comparison is complemented with qualitative opinions to confirm the extent to which the changes resulted from the intervention, and also to estimate the influence of other factors on changes observed.

Some experts proposed collecting farmers' own self-reported data regarding changes in these indicators at more frequent intervals, either through interactions with the app or through engagements with field facilitators or lead farmers. These qualitative methods might not help establish direct attribution, but could offer valuable insights by amplifying the voices of farmers and allowing deeper exploration of how the changes are happening, or what prevents positive change from happening.

- *New frontiers*

Some experts also suggested exploring the use of new technologies such as artificial intelligence and geospatial data for monitoring and evaluation efforts. For instance, there was a suggestion to investigate the potential of AI in summarising and analysing narratives shared by food producers reached through digital services, possibly by integrating AI functionalities into the app's chat function. Geodata is increasingly being used in monitoring and impact evaluation as well. The emerging frontier in this arena involves the precise mapping of individual food producers' plots (the opportunities of using geodata in monitoring and evaluating of FNS indicators is explored in detail in the next chapter).

4 Role of Geodata in Monitoring and Reporting on FNS Indicators



4. Role of Geodata in Monitoring and Reporting on FNS Indicators

Rapid technological advances have brought about exciting possibilities for enhancing M&E practices by incorporating spatial information and analysis for better quality data and cheaper, less intrusive data collection. This chapter provides a high-level summary of major opportunities and challenges associated with using geodata (or geospatial data) in M&E for projects focused on FNS. We offer insights into the potential benefits of incorporating geodata into M&E practices, while also recognizing the significant challenges that need to be overcome, as discussed in the workshop afternoon sessions.

Geodata in M&E

Rapid advancements in technology have created exciting opportunities in the field of geodata. Optical imagery with a spatial resolution as precise as 0.30 metres is already commercially available, while geostationary weather satellites can now provide images of the same area every 30 seconds. These developments in technology have paved the way for a wealth of new possibilities, enabling us to capture detailed and up-to-date geodata like never before. Geodata can serve multiple purposes in development projects, including tracking activities, planning field visits, mitigating risks and potentially even aiding in the measurement of some M&E indicators.

Many development organisations now use geodata to make informed decisions in planning projects and for their M&E efforts. Organisations such as the IFAD utilise satellite data to effectively measure impact and monitor progress in various projects. One notable approach to impact measurement involves employing treatment and control groups to assess the impact of improved market access on income growth. This is achieved by calculating the catchment areas surrounding each market and determining the distance between households and the nearest market. Such comprehensive data analysis allows for a robust evaluation of project outcomes and their influence on economic factors.

Other international organisations such as FAO and UNDP use geospatial data to assess crop productivity, analyse climate patterns, identify suitable areas for agricultural expansion and monitor changes in land cover and land use.

Opportunities

Geodata, gathered from various sources like satellites, remote sensing technology, and geographic information systems (GIS), offer unique advantages when used for M&E. They allow for precise tracking of changes in different locations, enable localised assessments of some programme impacts, and provide in-depth insights into the geographical distribution of various indicators. Notably, geospatial data holds great promise in monitoring selected FNS indicators.

By leveraging this data, we can better target interventions and make well-informed decisions, ultimately enhancing the effectiveness of programming contributing to the FNS goals. Geospatial data presents numerous valuable opportunities for enhancing monitoring and evaluation efforts, including:

Targeted Interventions: Geospatial data helps identify areas with specific needs, enabling the design of tailored interventions to address unique challenges in different locations. For instance, it can pinpoint regions experiencing water scarcity, soil degradation, or exceptional vulnerability to climate change. Armed with this granular information, organisations can design interventions that precisely address these localised challenges. Whether it's the implementation of efficient irrigation systems in drought-prone areas, soil remediation practices in regions with soil erosion, or climate-resilient agriculture techniques in areas susceptible to extreme weather events, geospatial data empowers development efforts to be highly effective, maximising impact and resource allocation where it matters most.

Baseline and Impact Assessments: Geospatial data assists in establishing baselines and assessing impacts of interventions by comparing spatial data before and after programme implementation, measuring changes in variables such as land cover, accessibility, and proxies for household poverty levels (e.g. monitoring roof conditions, see Table 6). It allows for a real-time monitoring of programme activities, facilitating timely identification of challenges and deviations from planned interventions for prompt corrective actions especially for locations that are costly to visit for monitoring and data collection.

Selection of Comparison Groups: Geospatial data, combined with matching techniques, aids in selecting appropriate comparison groups for impact evaluations, ensuring accurate assessments of programme impacts. By leveraging geospatial information alongside advanced matching techniques, organisations can thoroughly identify suitable comparison groups. This selection process ensures that the comparison groups closely resemble the target population, thereby minimising biases and external influences that might confound impact assessments.

Data Integration: Geospatial data can be integrated with other datasets, such as satellite imagery, crop calendars, and census data, for a comprehensive understanding of the programme's context and influencing factors. The combination of geospatial data with census information provides a deeper understanding of the demographic and socioeconomic characteristics of the target populations. This integrated approach unveils critical insights into the communities being served, allowing organisations to tailor interventions based on the unique needs and challenges specific to different regions.

Enhanced Estimation Models: Leveraging geospatial data as a covariate in survey data estimation models enhances the precision of impact estimates by accounting for spatial variations. This approach allows evaluating whether the target and control groups experienced the same (geospatial) external trends. This is important not only for only tailoring interventions but controlling for geospatial factors during impact evaluation.

Change Detection and Sustainable Land Management: Geospatial data enables measuring long term change detection, identifying deforestation and infrastructure changes. Satellite data can be used for monitoring of sustainable land management practices, including crop rotations, tillage methods, harvest dates, and water productivity, aiding in scaling and insights for sustainable agriculture. Furthermore, it aids in tracking harvest dates, offering insights into optimising agricultural schedules for higher yields and reduced environmental impact.

Livestock Counting and Monitoring: Geospatial data, combined with satellite imagery and advanced technologies, offers a promising opportunity for accurate and efficient livestock counting. Machine learning algorithms and computer vision techniques can analyse satellite images to identify and track livestock, providing essential data for inventory management and disease control.

Potential Challenges and Limitations

Utilising geodata for M&E present opportunities to gain spatial insights into programme outcomes, but it is crucial to acknowledge and address the challenges that can impede its effective implementation and utilisation in evaluation processes. These are some of the potential challenges of using geodata for M&E.

Data Quality and Availability: Obtaining consistently high-quality and accurate data can be challenging. While geospatial data holds immense potential, the task of obtaining data that is consistently high in quality and accuracy can prove to be a significant challenge. This issue is especially visible in settings where resources are constrained, including limitations in financial capabilities, technical infrastructure, and human resources. In such environments, the collection, maintenance, and regular updates of geospatial data can be difficult.

Technical Expertise and Infrastructure: Effective utilisation of geospatial data requires specialised technical skills and technology. There is a high bar to entry for development sector actors that wish to make use of geodata for M&E. Inadequate capacity and resources for data collection, processing, and analysis can hinder the effective use of geospatial data.

Addressing Ethical and Privacy Concerns: The use of geospatial data in M&E is not without its ethical and privacy dilemmas. Geospatial data can often include sensitive information, such as the locations and activities of individuals or communities, raising significant concerns about data privacy and ethical data handling. Ensuring that beneficiaries' rights are protected while extracting valuable insights from geospatial data is possible, but also complex.

Striking the right balance between data transparency, anonymization, and protecting individuals' identities becomes paramount. Moreover, there is a need for clear guidelines and ethical frameworks to govern the responsible collection, storage, and use of geospatial data in M&E. Varied data privacy regulations in different countries can pose challenges for geospatial data usage in M&E. These ethical and privacy concerns add an extra layer of complexity to the landscape of geospatial data usage.

Data Integration and Standardization: Integrating geospatial data with other datasets can be challenging, due to differences in formats, coordinate systems, and data structures. Achieving compatibility and

standardisation across these diverse datasets can be time-consuming and resource-intensive. It requires complex technologies to ensure that different datasets can work together harmoniously. Additionally, establishing common data standards and protocols becomes essential to facilitate data exchange and interoperability among various stakeholders. Overcoming these technical and organisational challenges is crucial for unlocking the full potential of geospatial data in M&E.

Answering 'How' and 'Why' Questions: Geospatial data on its own can be of limited use for answering 'how' and 'why' questions, especially about social change. Geospatial information excels in providing spatial context and patterns but may fall short in explaining the underlying causality or motivations behind observed phenomena. Therefore, geospatial data is often more effective when used alongside other research methods and diverse types of data collection. Combining geospatial data with qualitative research, surveys, and social science approaches can provide a more comprehensive understanding of the 'how' and 'why' aspects of the issues at hand.

Recommendations on Leveraging Geodata to Measure the FNS indicators

In spite of these challenges, there is significant potential for geodata to inform a number of FNS indicators, either directly or indirectly. For instance, when tracking the number of hectares of farmland under conservation practices or people becoming more resilient to shocks, geospatial data provides a powerful tool to capture precise information in real-time (or close to it). Satellite imagery allows precise mapping of land use changes, soil health, and vegetation cover. This detailed spatial information helps identify areas where conservation practices are effectively implemented and where interventions are needed. Moreover, geospatial data aids in assessing the impact of these practices on crop yields and the environment, contributing to the measurement of FNS indicators related to agricultural sustainability.

However, geospatial data's true potential is realised when it complements traditional measurement methods. Integrating remote sensing with on-the-ground surveys and assessments enhances the accuracy and comprehensiveness of FNS monitoring. For instance, when determining 'the number of small-scale food producers who progressively realise a living income or decrease the yield gap', geospatial data can provide critical insights into local agricultural conditions and productivity and by combining this data with household surveys and income assessments, a more rich understanding of livelihood improvements can be achieved.

Current measurement tools: "Traditional" approaches for M&E of programmes supporting nutrition and food security include household surveys, household dietary assessments, anthropometrics measurements of height and weight, and other quantitative and qualitative techniques. In the table below, we present each of the FNS indicators with the "traditional" measurement methods and measurement tools - survey instruments or indices - used to measure them:

Table 5: Traditional M&E methods and tools best suited to FNS indicators

FNS Indicator	Traditional Measurement Methods	Major Measurement Tools
A.1.1 Number of people with a more diverse and adequate diet	Household Surveys, Dietary Assessment	Household Dietary Diversity Score (HDDS) Household Hunger Scale (HHS) Minimum Acceptable Diet (MAD) Minimum Dietary Diversity for Women (MDD-W)
A.1.2. Number of people whose nutritional situation became more resilient to shocks	Household Surveys, Anthropometric, Measurements, Market price trends	Food Insecurity Experience Scale (FIES) Household Food Insecurity Access Scale (HFIAS)
B.1.1.Number of small scale food producers that progressively realise a living income	Income and Livelihood Surveys	Multidimensional Poverty Assessment Tool (MPAT)
B.1.2 Number of small scale producers that progressively **decrease** the yield gap.	Crop yield gap (actual yield as % of attainable yield)	
B.1.3 Number of female small scale food producers that progressively empower	Qualitative Research, Women's Empowerment Surveys	Women's Empowerment in Agriculture Index (WEAI) See also, Project-Level WEAI (Pro-WEIA)
B.1.4 Number of small scale food producers whose livelihood became more resilient to shock	Livelihood Surveys, Economic Assessments	Climate Risk Assessment tool (CRA) Poverty Probability Index (PPI) Rural Household Multi-Indicator Survey (RHoMIS)
C.1.1.Number of hectares of farmland under >2 conservation practices:	Agricultural Surveys, Land Use Assessments	Climate Risk Assessment tool (CRA)
C.1.2 Number of hectares of farmland that agro-ecologically became more resilient to shocks	Soil and Biodiversity indicators, Agricultural Surveys, Land use assessments, Time series survey, Variety crop species	

Geodata and FNS indicators: Experts recognize that geospatial data presents a remarkable opportunity in the realm of FNS indicators. There was considerable enthusiasm at the workshop about the potential of geodata to significantly enhance our capacity to measure and monitor specific indicators related to agricultural practices, land use, and environmental factors. Satellite imagery was acknowledged as an invaluable tool for tracking changes in farmland under conservation practices, assessing agricultural sustainability, and understanding the resilience of food producers to various shocks.

However, it was also emphasised that while geospatial data contributes substantially to FNS monitoring, it cannot replace the need for traditional measurement methods for all indicators. Instead, a balanced approach that combines the strengths of both geospatial data and traditional measurement tools was deemed essential for achieving comprehensive and accurate assessments of food and nutrition security.

Below is an example of some of FNS indicators and possible monitoring using remote sensing:

Table 6: Possible application of remote sensing to measurement of FNS indicators

Indicator	Potential use of remote sensing
A.1.1 Number of people with a more diverse adequate diet	While geospatial data may not directly measure dietary habits, it can indirectly aid in assessing food security and nutrition. It helps gauge dietary diversity through crop diversification, assesses garden availability and market access, and estimates stature via shadow analysis. Emerging technologies enable the assessment of the nutritional value of crops, offering a more comprehensive understanding of the food landscape.
A.1.2 Number of people whose nutritional situation became more resilient to shocks	Asset Assessment: Satellite data can be employed to assess roof materials and conditions, particularly identifying signs of rust or deterioration. Such findings can indirectly indicate the economic assets of households. In areas where poor roof conditions are prevalent, it suggests low asset levels, which can influence nutritional resilience. Livestock Counting and Management: Satellite data can also contribute to counting livestock, which is an important asset for many households. By accurately monitoring livestock populations, it becomes feasible to implement livestock substitution strategies during times of need. For instance, surplus livestock can be sold to supplement income, providing a safety net during shocks, and thereby enhancing nutritional resilience.
B.1.1 Number of small-scale food producers that progressively realise a living income	Indirect measurements such as land measurements and counting livestocks can be applied to estimate the change in living income of a farmer.
B.1.2 Number of small-scale producers that progressively decrease the yield gap	Proxies such as yield, biomass, land use measurements, classification model and Identification index can be used. FAO'S WAPOR resource monitors and reports on agriculture water productivity over Africa.
B.1.3 Number of female small-scale food producers who become progressively empowered	No direct measures or proxies available using geodata.
B.1.4 Number of small scale food producers whose livelihood became more resilient to shocks	Methods developed for estimating household poverty levels from high-resolution satellite imagery have been under development for some time. While resilience to shocks is a broader concept, characteristics of households that are proxies for resilience to shocks may also be observable through similar methods.
C.1.1 Number of hectares of farmland under at least 2 conservation practices	FNS guidance monitoring practices such as minimal soil disturbance, permanent soil cover, and drop diversification (intercropping or rotation). All three practices can be monitored with remote sensing using time-series data, provided the resolution is sufficient to match agricultural plots.
C.1.2 Number of hectares of farmland that agro-ecologically became more resilient to shocks	This indicator should be monitored through proxy indicators such as soil organic carbon. Though challenging to measure through remote sensing, companies like GeoTree are working on ways to model soil organic carbon using a time-series of high-resolution data from the Sentinel-2 satellite.

Experts acknowledged that geospatial data alone may not always provide a complete picture for all FNS indicators, it is essential to integrate multiple data sources, such as household surveys, agricultural assessments, and nutritional studies, alongside geospatial data. This combination allows for a more holistic understanding of FNS dynamics.

5 Roadmap towards Greater Adoption of Geodata for FNS M&E

5. Roadmap towards Greater Adoption of Geodata for FNS M&E

Geodata has the potential to change M&E for the better in projects contributing to the FNS goals. If done right, geodata can help us do M&E work more cheaply and more quickly, with less burden on project participants, and with more accuracy than other methods. It enables the assessment of land use patterns, agricultural productivity, and environmental changes, which are critical components of FNS. Geospatial data enables precise mapping and tracking of various factors, making it a valuable tool for understanding FNS dynamics.

Of course there are also limits, not only to what geodata can tell us (on its own) but also to how willing practitioners and donors are to use geodata and data derived from it for M&E purposes. Geospatial data alone can only tell us so much about 'how' and 'why' things like crop yields, land use and nutritional security might change. Some components of FNS, women's empowerment in agriculture being a prime example, are very challenging to measure through geospatial data, as they require nuanced understanding and qualitative data that geospatial technologies cannot provide.

Even still, geodata can provide useful direct and indirect evidence to inform most of the MFA's FNS indicators. Geodata can also provide data for useful proxy and supporting indicators that can help project teams, donors and stakeholders understand the factors that enable or constrain progress towards FNS goals.

If making the greatest use possible of geodata for M&E in FNS projects is the destination, what steps do we need to take to get there from where the sector stands now? Based on our background research and consultation with experts at the September 2023 workshop, we propose the following steps in a roadmap towards greater acceptance and use of geodata in our sector:

Step 1: Engage with donors to accept geodata for M&E
What should be done? One clear lesson-learnt is that development practitioners are only incentivised to use geodata in project M&E when multilateral, bilateral and private donors accept and encourage geodata in the M&E frameworks of projects and programmes they support. Without this, there is no "demand" for geodata for M&E and little incentive for practitioners to work with these methods.

How can we turn sceptical or unaware donors into enthusiastic supporters of geodata for M&E? The European Space Agency identifies addressing knowledge and capacity gaps among donors as a key starting point, and convened its Space for International Development Assistance (Space for IDA) programme to do just that. More efforts must be made to build knowledge about geodata and its uses among donors, through new publications, easy-to-use data tools and hands-on demonstrations of what's possible. Then, capacity building is needed to help donors and other stakeholders make use of geodata for M&E themselves as part of their ongoing work. With knowledge raised and capacity strengthened, we can then facilitate further transfer of advanced skills from geodata practitioners to donors, and foster true adoption of geodata for M&E.

Efforts to standardise the definitions and measurement approaches used by digital service providers and development actors in M&E, such as the DAC Impact Measurement Tool, should also help boost donor confidence in these data.

Who should do this? ESA is an authority on the topic of using geodata in development work but other actors in the sector also have a role to play, particularly NSO in the Netherlands context (see following point). Development practitioners can help make the case to donors by writing in geodata for M&E in project proposals and sharing back results of M&E work incorporating geodata in progress and accountability reporting. Especially helpful will be cases where "traditional" M&E tools are used alongside geodata approaches for similar indicators, providing needed data for validating the use-case of geodata for M&E. Academics, researchers and geodata providers should bring more and better evidence and new innovations to the public's attention through the media, professional meetings and conferences.

How can NSO support? NSO holds a unique position in the development cooperation landscape in the Netherlands from which it can convene and influence policymakers in the Dutch MFA, as well as development and humanitarian organisations and geodata providers. NSO could support adoption of geodata for M&E among MFA policymakers and MEL experts through a follow-up workshop dedicated to working just with MFA stakeholders on knowledge development and capacity building on geodata for M&E, following the approach suggested in ESA's Space for IDA programme. Such a workshop should involve a range of MFA policy and MEL experts, and be organised around finding solutions to MEL challenges that these professionals face in their own work.

A facilitation team comprising experts on human-centred design, M&E and geodata technology would then work with the MFA experts to find ways where geodata can help respond to pressing challenges, providing practical examples and hands-on opportunities to engage with these methods themselves. The workshop could be followed with a pilot study to put a limited number of geodata for M&E innovations into practice in existing or new programmes, with a short feedback timeline to provide evidence for "ground-truthing" geodata approaches.

Step 2: Identify the right "traditional" M&E methods to support geodata in practice

What should be done? Geodata can provide a great deal of useful M&E data, but it can't provide everything we need to track FNS indicators. With the partial exception of the sustainable land use indicators, reporting on FNS indicators will require the use of other "traditional" M&E methods. However, combining remote sensing data with on-the-ground surveys, assessments, and qualitative data can provide a more comprehensive and accurate understanding of FNS impacts. This synergistic approach would enable a holistic assessment of progress toward FNS goals, accounting for both quantitative and qualitative aspects.

It would also allow for the establishment of attribution - or causality - when evaluating some interventions, as required for full reporting on some FNS indicators. Impact evaluators Laterite provide an example of this. They use geospatial data to guide the design of survey-based experimental impact evaluations that can help explain not only what changes have happened in a given outcome, but also how attributable that change is to the intervention of a development practitioner. Other methods that may pair well with geodata inputs include mixed-methods and quasi-experimental impact evaluations, ex-post impact evaluations, process evaluations and qualitative methods like Contribution Analysis and Most Significant Change.

Who should do this? Development practitioners, especially larger NGOs with considerable staff capacity and large-scale projects, should take the lead in integrating geodata and remote sensing approaches alongside more traditional, tried-and-true M&E methods. Using both types of methods to look at changes in specific FNS indicators will also provide useful evidence of "ground-truthing" geodata approaches, enabling the sector to learn which geodata approaches are the best complement or alternative to existing M&E approaches.

How can NSO support? Chapter 4 of this report highlights "traditional" M&E methods applicable to FNS indicators as well as geodata approaches that are directly or indirectly applicable. NSO can help raise awareness among MEL experts in the Netherlands (and beyond) by sharing the findings of this chapter widely through written briefs, social media, workshops and conferences, and by incorporating these findings as guidance for M&E practice in future NSO programmes.

Step 3: Harness new developments in geodata and remote sensing

What should be done? The remarkable advances in geodata availability and precision creates incredible opportunities that front-runners in our sector are already embracing. For example Justdiggit is using satellite imaging to track the progress of landscape regreening projects, as well as to select promising sites for new interventions. Remote sensing can assess soil moisture and other variables of soil health. And increasing satellite resolution allows for counting of objects, from buildings down to livestock, from the sky. All provide new tools for measuring aspects of the FNS indicators. Such cases are exciting and eye-catching, and help raise awareness of the possibilities of using geodata for M&E in FNS projects.

Who should do this? Practitioners, especially NGOs and their partners delivering projects that support FNS goals, should make use of these new technologies where possible in their existing M&E frameworks. Geodata providers can strike partnerships with these organisations to show the use-case of what geodata technologies are capable of. More platforms for M&E experts and geospatial experts to come together and share new advances and best practices will facilitate this. Greater use will help build a base of knowledge in our sector about what we can achieve using geodata and how it supports M&E in FNS projects.

How can NSO support? One take-away from the September 2023 workshop is that there is great value in convening experts in development policy, MEL and geodata technology, to exchange and update each other on best-practices, emerging trends and pressing challenges at the intersections of these fields. NSO can support future gatherings - in-person and virtual - to bring these groups together more frequently to advance the field and practice of geodata for M&E together.

Annex: Results of Workshop Break-out Sessions

In this Annex, we feature photos of the activity canvases filled in by participants in the morning and afternoon break-out sessions of the workshop held on September 5th, 2023, along with bullet-point highlights from each groups' work. Key take-aways from the work of the break-out groups have also been incorporated throughout the text of this report. The break-out sessions were structured as follows:

AM Break-outs: Groups brainstormed answers to key questions about adopting and using geodata for M&E raised in the background briefs circulated to participants ahead of the workshop.

PM Break-outs: Groups worked together on specific FNS indicators to identify the "traditional" M&E approaches most applicable to each indicator, available (or potential) geodata approaches for monitoring each indicator, and their assessment of the likelihood that geodata could be brought to bear on measuring this indicator in the short-term.

AM break-out sessions

Discussion Question: How might digital service providers more effectively collect and use qualitative data from users?

Highlights

- Arrange two-way communication through digital services and ask users for simple information/ feedback
- Ask users to report their satisfaction on the use of tool at workshop, use feedback for tool improvement and impact measurement
- Request user feedback via mobile app
- Clearly separate intermediaries and end-users
- Establish intervention and comparison groups among farmers using digital services early to permit collection of multi-year data that can help demonstrate impact
- Ask users to take and share videos, pictures of their crops, markets, homes, communities
- Employ mixed method design (FGD, Outcome Harvesting, Most Significant Change or other methods) with digital service users
- Incorporate questionnaires with open questions to share user experiences via mobile apps
- Leverage USSD/phone surveys among users to collect input
- Set clear learning questions to structure gathering of qualitative input
- Take videos and blogs with testimonies
- Combine training sessions with feedback questions
- Ask digital service users for informal feedback on the service
- Before starting, design iterative process of M&E and improvement

Top Ideas, based on group member prioritisation

- Don't only collect but also have a robust plan to analyse qualitative data
- Most significant change stories with photos and videos of use
- Collect qualitative data via field visits (interviews with a selected participants)

Discussion Question: How might a program involving digital service providers establish attribution for challenges in farmer income and yields through its M&E system?

Highlights:

- Employ Before-and-After -Control-Impact (BACI), but remember impact takes time
- Work with an independent M&E party
- Randomised Control Trials (RCT)
- Use statistical matching to compare farmers with just 1 difference between them (simpler than RCT)
- Collect qualitative data on the perceived mechanism behind changes in farmer income and yields
- Quarterly survey using app
- Survey (reach out to farmers we intend to work with)
- Change in trends (time series from the point of intersection)
- Randomize promotion of services (as opposed to strict RCT)
- Compare intervention area with a comparable reference area to approximate impact
- Qualitative or quantitative self-reporting of farmer income and yields
- Focus on creating intra- interrelated comparisons as opposed to creating real control groups you could possibly create with the service you provide
- Map out the causal chain/funnel of attrition - of the people reached, what share experience a given outcome or impact?
- Use narrative + AI to summarise and structure qualitative responses

Top Ideas, based on group member prioritisation

- Collect qualitative stories of change to help establish attribution for change
- Use data on mobile phone use and type of phone among user group as a rough proxy for wealth
- Compare data for intervention and comparison areas, or pre-post comparisons to track changes in farmer income and yield and guide conclusions about attribution for any impact

Discussion question: How might a future program like G4AW motivate and support its subsidy recipients to make impact measurement a part of their regular way of doing business, and not just another donor requirement?

Highlights:

- Make it light-touch
- Use DAC tool (focus on frequent ease to use meaningful indicators)
- Standardisation vs. flexibility; ensure KPIs match reality and interest of users, donors
- Relate impact to the earning model of businesses supported
- Consider impact measurement as a requirement for future/upcoming funding
- Adjust impact assessment to product development
- Align measurement on impact with interest of private investors
- Feedback system - create simple channels to collect farmer feedback on supported services and share the outcome of the data back to farmers.

Top Ideas

- Showcase the impact of monitoring on business improvement
- Ensure feedback from and engagement of those served by subsidy recipients in programme M&E
- Align design of future programme with needs and desires of end-users
- Create a dashboard with anonymized, visualised data that end-users have access to, including (automated) narrative conclusion/ recommendations, which end-users use to showcase their business potential funders.

Discussion question: What are the best practices for collecting data from farmers that they may be uncomfortable sharing, for example on income and yields?

Highlights:

- Add an incentive for farmers to share data
- Consider using proxy indicators, for example the PPI in place of cash income or wealth
- Take care to train survey enumerators well
- Use standardised, localised units of measure (e.g., kg, local crates or truck)
- Use income quintile for areas as a benchmark
- Ask questions from an appreciative perspective - respondents may be more willing to share
- Ask relative questions
- Take informed consent seriously and collect data anonymously
- Investigate seasonality to decide when to do baseline and endline
- Use local languages/interpreters during data collection

Top Ideas

- Work with a local 'lead farmer' to facilitate surveying/interviewing
- Collect data about proxies for income instead of asking about income directly (often a sensitive question)
- Measure indirect effects, for example quality of roofing materials, presence of satellite dishes as proxies for wealth (remote sensing can also help here)

PM break-out sessions

Groups working on FNS indicators on nutrition

Highlights on nutrition indicators:

FNS indicator →	A.1.1 Number of people with a more diverse and adequate diet	A.1.2. Number of people whose nutritional situation became more resilient to shocks
"Traditional" approaches to measurement	• Household surveys • Off-the-shelf survey instruments • Household Hunger Scale	• Household surveys • Market price trends • Tracking exports and imports of food • Analysing photos of household consumption basket
Feasibility of measuring this indicator or a proxy using remote sensing	• Limited feasibility for direct measurement	• Limited feasibility for direct measurement
What proxies could be used	• Analysing photos of household consumption basket • Changes in crop maps • Landscape diversity • Number of animals owned • Distance from farms and villages to markets and roads	• Net primary productivity measures • Weather extremes (rainy season, drought) • AI analysis of photographs of local markets (to analyse presence, absence, diversity of food available)
How does/could remote sensing support measurement	• Most factors above can currently be measured by remote sensing	• Measuring crop variation in an area • Measuring water availability
Comments / questions raised	Participants wished for clearer, more detailed definitions of the FNS indicators Farms/plots must have sufficient scale to be measurable by satellite	Are these indicators applicable in urban contexts, as well as rural? Could drone imagery be helpful in urban settings?

Groups working on FNS indicators on farming and agricultural performance

Highlights on farming and agricultural performance indicators:

FNS indicator →	B.1.1. Number of small scale food producers who progressively realise a living income	B.1.2. Number of small-scale food producers who progressively decrease the yield gap
"Traditional" approaches to measurement	• Household surveys • Baseline and endline comparisons of intervention and comparison groups • Training attendance and completion • Measuring income and wealth through physical assets (housing material, livestock, owning consumer goods, etc)	• Household surveys • Baseline and endline comparisons of intervention and comparison groups • Determine potential yield for an area • Determine cause of changes in yield gap
Feasibility of measuring this indicator or a proxy using remote sensing	• Medium feasibility (for example, estimating crop quality or counting livestock by satellite)	• Medium feasibility (WaPOR is one example, or estimating crop yields by satellite)
What proxies could be used	• Relative wealth index	• Yield, biomass, and land use measurements • Crop model • Use AI to identify small-scale producers
How does/could remote sensing support measurement	• Variability assessment spatial + temporal • GPS tags	• Help identify a suitable area or communities for a comparison group
Comments / questions raised	Pixels aren't people; most individual and household characteristics are very challenging to measure remotely	

Highlights on farming and agricultural performance indicators, continued:

FNS indicator →	B.1.3. Number of female small scale food producers who become progressively empowered	B.1.4. Number of small-scale food producers whose livelihood became more resilient to shocks
"Traditional" approaches to measurement	• Women's land ownership, formal land registration • Women's employment and jobs in agri value chains • Empowerment indices (for example WEAI) • Women's decision -making power	• Income diversity • Presence of support systems (access to financial institutions, other forms of credit)
Feasibility of measuring this indicator or a proxy using remote sensing	• Low feasibility (very hard to measure remotely)	• Low feasibility (very hard to measure remotely)
What proxies could be used	• Proximity to childcare and schools • Distance to market and water points	• Presence of crop pests and disease • Crop planting schedule
How does/could remote sensing support measurement	-	-
Comments / questions raised	-	-

Groups working on FNS indicators on sustainable land use

Highlights on sustainable land use indicators:

FNS indicator →	C.1.1 Number of hectares of farmland under at least 2 conservation practices	C.1.2. Number of hectares of farmland that agro-ecologically became more resilient to shocks
"Traditional" approaches to measurement	• Farmer surveys • GPS mapping • Estimation based on land size	• Farmer surveys • Monitoring varieties of crops raised, crop diversification and intercropping
Feasibility of measuring this indicator or a proxy using remote sensing	• Good feasibility	• Moderate feasibility
What proxies could be used	• Tree cover • Biomass • Cropland pre- and post-intervention • Soil structure • Erosion	• Tree cover • Biodiversity • Fire susceptibility • Drainage of soil or water retention
How does/could remote sensing support measurement	• Factors above can currently be measured, as long as borders of land holdings are formalised and digitised	-
Comments / questions raised	-	-

This is a publication of
The Netherlands Space Office
Prinses Beatrixlaan 2
2595 AL | The Hague
PO Box 93144 |2509 AC The Hague
Tel. +31 (0)88 0424500
E. G4AW@spaceoffice.nl
g4aw.spaceoffice.nl

The Geodata for Agriculture and Water (G4AW) programme stimulates sustainable food production, a more efficient use of water in developing countries, and aims to alleviate poverty by enhancement of sustainable economic growth and self-reliance in the G4AW partner countries. G4AW provides a platform for partnerships of private and public organisations. Together they provide food producers with relevant information, advice and financial products.

G4AW is a programme by the Dutch Ministry of Foreign Affairs within the policy priorities for food security and water, which is executed by the Netherlands Space Office (NSO).

G4AW
GEODATA FOR AGRICULTURE AND WATER

Netherlands Space Office

Ministry of Foreign Affairs of the Netherlands

bop inc