Coffee farmer in Vietnam ©ICCO/GREENcoffee project

Space for Food Security

Opening and stimulating an emerging market

Part 2: Sustainable Business Models and Scaling (Main Report)

This report has been commissioned by the Netherlands Space Office and supported by the Ministry of Foreign Affairs in the framework of the G4AW programme.

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Table of contents

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Foreword

Smallholder food systems must be made more resilient to future shocks such as floods, droughts, and disease. Urgent and sustainable increases in food production are needed to reduce reliance on food imports and reduce poverty, and this is where digital services come into play. Digital services are the gateway to farm loans, crop insurance, and greater economic security, which in turn enables farmers to increase their resilience to climate change by experimenting with new, drought-resistant crops, for example, or innovative farming methods. Text messages with weather reports help farmers make better decisions about when and what to plant, and when to harvest.

With mobile phone ownership in Sub-Saharan Africa alone expected to reach half a billion in 2021, digital services offered via text messaging can reach even the most remote village. And at least one-fifth of these phones also have smart features, meaning they can connect to the internet. However, on the African continent only 13-35 percent of farmers currently use digital solutions. Core digital and data infrastructure is still lacking and the digital literacy of smallholders and extension providers can be low. In addition, private sector involvement is limited due to investment risks, barriers to scaling services and insufficient knowledge on sustainable business models.

Yet transforming food systems digitally has demonstrably excellent results: the African Development Bank, which has allocated over half of its climate financing to adaptation since 2019, has already helped 19 million farmers in 27 countries to lift yields by an average 60 percent through applying digital technology. Once developed, the digital nature of these services often makes such projects easy to replicate elsewhere and scale, even across large rural areas with little existing infrastructure.

This is why the Global Center on Adaptation and the African Development Bank have launched the Africa Adaptation Acceleration Program (AAAP) to mobilize $25 billion to scale up and accelerate innovative climate-change adaptation across Africa. Its Climate Smart Digital Technologies Pillar aims to scale up access to and uptake of digital solutions for 30 million smallholders in Africa by 2025.

The work of the G4AW Facility in Africa and Asia, and the lessons shared in this report, are a valuable resource on how to leverage the opportunities that geodata and digital or data-enabled tools provide. We have the means and the technical capability to put smallholders well on the way to achieving food self-sufficiency and greater climate resilience. In doing so, we can help millions move out of food poverty. We must not squander this opportunity to create truly historic and lasting change.

Patrick Verkooijen

Chief Executive Officer
Global Center on Adaptation

Abbreviations

AAP	Africa Adaptation Acceleration Program (Global Center on Adaptation and the African Development Bank programme)
ARC	Agricultural Research Country
B2B	Business-to-business
B2C	Business-to-consumer
BCR	Benefit-to-cost ratio
BMKG	Indonesian agency for meteorology, climatology, and geophysics
CRL	Commercialisation Readiness Level
CROPMON	Crop Monitoring Service (Kenya, G4AW project)
CSR	Corporate Social Responsibility
D4Ag	Digitalisation for Agriculture
DCAS	Digital Climate Advisory Services
EO	Earth Observation
ESA	European Space Agency
G4AW	Geodata for Agriculture and Water
G4IFF	Geodata for Inclusive Finance and Food
G4INDO	Geodata for upgrading smallholders' farming systems (Indonesia, G4AW project)
GAP	Good Agricultural Practices
GCA	Global Commission on Adaptation
GIACIS	Geodata for innovative Agricultural Credit Insurance Schemes (Ethiopia, G4AW project)
GPS	Global Positioning System
ICCO	Interchurch Organization for Development Cooperation (now part of Cordaid)
ICF	Interdisciplinary Centre for Food Security
IDSS	Intelligent Decision support System (Bangladesh, G4AW project)
IPR	Intellectual Property Rights
IT	Information Technology
ITC	University of Twente faculty of geo-information science and earth observation
KNMI	Konkinklijk Nederlands Meteorologisch Instituut (Royal Netherlands Meteorological Institute)
LASA	Indonesian National Institute of Aeronautics and Space
MFI	Micro Finance Institutions
MVP	Minimum Viable Product
MODHEM	Mobile Data for Moving Herd Management and better incomes (Burkina Faso, G4AW project)
MUISS	Mobile User-owned ICT4Ag-enabled Information services (Uganda, G4AW project)

NGO	Non-Governmental Organisation
NDVI	Normalized Difference Vegetation Index
NMA	National Meteorological Agency
NpM	Netherlands Platform for Inclusive Finance
NSO	Netherlands Space Office
PCA	Partnership Cooperation Agreement
PPP	Public-Private Partnership
R4A	Rain for Africa (South Africa, G4AW project)
SaaS	Software as a Service
SAM	Smart Agriculture Myanmar Programme (Myanmar, G4AW project)
SAWS	South African Weather Services
SDG	Sustainable Development Goal
SIKIA	SAGCOT Integrated Knowledge and Information for Agriculture (Tanzania, G4AW project)
SMS	Short Message Service
SNV	Stichting Nederlandse Vrijwilligers / Foundation of Netherlands Volunteers
UI	User Interface
UX	User Experience
WUR	Wageningen University and Research

Executive summary

The G4AW Facility launched in 2013 with the objective of creating digital advisory services for smallholders based on the use of satellite data. This report focuses on the business-related decisions and the steps taken to move towards a sustainable business model and scale to other services and regions. Only several years after the project's completion will it become clear whether these partnerships were successful. This is an important disclaimer to this report: we present observations based on the current state of affairs. These are insights into the steps taken, underlying reasoning, and future plans. At this stage, we cannot give a clear roadmap as each service is unique and more time will be needed to draw robust conclusions. However, we provide recommendations based on common denominators.

The most important reason to make the development of a sustainable business case one of the main objectives of the G4AW Facility was to ensure the financing of long-term service provision. As G4AW was one of the early adopters of digital advisory services (using satellite data) for smallholder farmers in the agricultural sector in developing countries, opening new markets was a key focus. Being one of the first programmes to introduce smallholders to the potential of satellite data for improving their livelihoods, farmers needed to be convinced that they would receive a continuous service rather than just being given advice during a 'short' project. This would help convince smallholders of the potential, paving the way for large-scale uptake of digital services both in the G4AW programme and beyond.

While smallholders are central to most of the objectives of G4AW, it was assumed from the outset of the G4AW programme that smallholders would have only a limited capacity and willingness to pay for the services, e.g., 5-10 euros per year (<1% of annual income). Many projects carried out assessments of the willingness to pay, which varied greatly between countries, target groups and type of services. Even if smallholders were willing to pay, they were generally only prepared to pay a limited amount that by itself was not sufficient to recover costs in the first years. Other challenges related to having smallholders as paying customers are that there is often competition from free (donor-funded) alternatives and that farmers often have difficulty accessing funding.

In order to reach a large number of smallholders, their needs should be addressed in a satisfactory manner. That means that the advice should be actionable, accurate, and inclusive (also reaching marginalised communities, women, and youth). This is based on a continuing user design trajectory that promotes digital inclusion. This user-centred design is discussed in part 1 of the publications setting out lessons learned.

The average number of organisations that participate in a G4AW partnership is seven. Each partner had a clearly assigned role and had to decide in what form they wished to continue after project ended. Only if a partnership is rewarding for all partners involved can it be considered healthy. This means each partner has to contribute towards and benefit from the creation of shared value. Involvement of local government institutions is often a prerequisite to have sufficient local support to embed and scale the services within certain regions.

Most partnerships understand that multiple target groups could potentially benefit from their services, including smallholders, medium and large farmers, food processors, input and food retailers, banks and other finance or insurance companies, governments, and NGOs. However, across the board, certain services are considered more valuable than others. Many G4AW partnerships believe they add the most value through the provision of accurate weather information and crop management advice. These more general service categories are highly relevant to different stakeholders, hence they yield the best benefit to cost ratio.

Most of the G4AW partnerships have started with the ambition to sell services within direct business-to-consumer (B2C) models via designated existing service providers or newly established social enterprises.

Envisat; Vietnam, Mekong Delta ©ESA

Most partnerships, however, have also added a business-to-business (B2B) approach to ensure additional and more stable revenues. The most important business challenge is to create a stable flow of income. There are many reasons why generating a stable income has been a great challenge in the G4AW partnerships. Some key underlying reasons include the difficulty of retaining customers, the unclear business commitment of the B2B partners and rapidly increasing (subsidised) competition.

Data related to farms and farmers is highly valuable for many of the potential B2B clients. This includes companies focused on providing financial access. The G4AW partnerships have collected a lot of data. This includes, amongst others, the registration of farmers (and pastoralists), plot delineation and crop types. It is important that partnerships understand the value of data early on in the process, and ensure that data is complete and validated. The data should be well documented (metadata), and ownership of data and privacy concerns (including emerging national policies) should be addressed. This will help to provide added value to B2B partners.

Entrepreneurial leadership is one of the most important preconditions for commercialisation and scaling of services. This entrepreneurial leadership has varied throughout the G4AW calls (limited in early calls, high in the most recent call). There is generally less leadership in the G4AW projects in Africa than in Asia. Many G4AW partnerships envisage the establishment of social enterprises to further embed and scale services, and a few have already created these.

Except for the challenge of entering new markets, most of the partnerships are facing additional challenges during project implementation and scaling. The COVID-19 pandemic and worsening conflicts in several G4AW countries (Myanmar, Ethiopia, Mali, and Burkina Faso) have not helped in this respect. At the same time, the opportunities for digital tools in the agricultural sector are clearly demonstrated. These tools do not only contribute to food security, but also increase sustainability, provide better information on and understanding of the market prices, and increase job opportunities in the agricultural and digital sectors.

Introduction

This document is the second of two publications with lessons learned from the G4AW Facility. The G4AW Facility was launched in 2013 with the objective of creating digital advisory services for smallholders, based on using satellite data. The first document has provided information on the background of the G4AW Facility. The main focus of the first document was on the design and development of the G4AW services. This included the design process, focus of provided services, targeted crops, commodities, clients' countries, and more. As most projects are moving to the final stages or are already finalised, all this information was readily available to give a good overview of many of the (non-business focused) decisions made by the partnerships during the project phase.

This second publication is more focused on the business-related decisions and the steps taken to move towards a sustainable business model and scale to other services and regions. The main challenge in this report is to separate the plans, the potential and the current practice. Some projects have already completely abandoned their business orientation, others have taken big steps to become financially sustainable, but only after several years will it become clear whether these partnerships have succeeded. This is an important disclaimer to this report: we can give an insight into the steps taken, underlying reasoning, and future plans. We cannot provide a clear roadmap, as the services are unique and will require a longer timeframe to draw more robust conclusions on impact and sustainability.

Many insights in this report are based on a survey conducted by BopInc in 2020 and 2021 commissioned by NSO (see box).

Bopinc study on G4AW partnerships and business models

Bopinc is a Netherlands based organisation specialised in strengthening entrepreneurship in low-income markets. Bopinc has contributed to one of the G4AW projects (GEOPOTATO) and has significant experience with supporting the creation and marketing of digital advisory services for the agricultural sector.

The study consisted of a survey and interviews, and its objective was to better understand the current progress of the partnerships and their most urgent needs in their transformation from project to entreprise. The surveys served as input to a process of technical assistance to the partnerships, also provided by Bopinc.

In total, 24 out of the 25 partnerships filled out the survey. This included a focus on the current product, the commercialisation readiness, scaling plans, and more. The output of the study is used in this report.

We hope that the information provided in this report will help policy makers and providers of digital advisory services in the agricultural sector to understand the challenges faced by the G4AW partnerships and learn from the decisions they have made to overcome these.

The document will first discuss the **rationale** why sustainable business models have been a key priority in the G4AW Facility. Second, the **success of services** (a recap of Lessons Learned part 1) will be discussed, and how these different services impact the possible business models (including the willingness to pay). This will also

discuss how service aspects (e.g., shareability, topics) and service delivery methods have an impact on the number of potential users and their willingness and capacity to pay for the use. And third, different types of **business models** will briefly be explained.

The following sections cover the performance and transformation of **partnerships**. What roles were covered in the initial partnerships and what roles have been missing? How satisfactory has the cooperation been, and what are the options for continuing cooperation and expanding partnerships? In addition, the **commercialisation** is discussed with a focus on the different routes taken by partnerships to overcome identified barriers to commercialisation, as well as the role of technical assistance in further **scaling** of the services.

Finally, a set of **recommendations** is provided regarding successful service creation, business models, partnership cooperation, and more.

Rationale

An analysis by the Netherlands Space Office (NSO) of over 250 research and demonstration projects on digital and geospatial innovation in the agricultural sector showed that most project activities ended when project budget expired. The G4AW Facility started in 2013 with the ambition to support the development of digital advisory and/or financial service provision using satellite data and other geodata. Each project's objective within this Facility was to reach 100,000 smallholder farmers (or 50,000 pastoralists or fisherfolk) and create a sustainable business model. The projects were implemented by public-private partnerships (PPPs). In many situations, cooperation between various parties, public and private, is an effective strategy to contribute to inclusive growth, i.e., economic activity that also benefits small food producers and entrepreneurs.

Public-private partnerships have a lot of potential in combining the best of both worlds, but it is also a relative new partnership structure in this context. Public organisations in the countries concerned can help with providing their endorsement, helping to understand the legal framework, providing the licence-to-operate, helping accessing local data, and especially by linking the required extension with existing government programs to be able to reach many farmers in a relatively short period.

A lot of knowledge and experience of the Dutch private sector in the field of geodata services related to agricultural advice was expected to be easily adaptable and transferable to developing countries. With this, the primary focus was on leveraging new technologies to contribute towards SDG2: Zero Hunger. A clear focus was placed on transferring the services to local service providers and also in this way to contributing to other SDGs as well, such as SDG 8: Decent Work and Economic Growth. This means that there had to be clear benefits for local entrepreneurs. A focus on sustainable business models helps to balance the benefits.

PPPs in the context of projects related to development cooperation are easily criticised for mainly supporting the private sector in the developed country and resulting in a technology push to places where a) the overall framework is not yet ready for this technology, or b) willingness or capacity to pay for these services once subsidy ends will not be sufficient to continue with these services. The most important reason to make the development of a sustainable business model one of the main objectives of the G4AW Facility was to ensure sustainability of service provision. In addition, the requirement to work through a PPP aims to ensure that local needs are taken into account, local governance is achieved and that the technology is in line with local demands and capacity.

As G4AW was one of the early adopters of digital advisory services (using satellite data) for the smallholder segment of the agricultural sector, where a key focus was opening new markets. In this position, being one of the first programmes to introduce smallholders to the potential of satellite data sourcing advisory and/or financial services to improve their livelihoods, farmers still needed to be convinced that they would subscribe to a continuous service rather than being recipients of advice during a short project. Smallholder buy-in would then pave the way for large-scale uptake of digital services both in the G4AW programme and beyond.

A second important reason why the business focus was so important in the G4AW Facility, is the assumption that this would empower smallholders. Being a direct or indirect (paying) customer of services would give smallholders a stronger voice in the key focus areas of the applications. Not only the initial user needs, but also emerging needs (such as new solutions needed to deal with the COVID-19 situation) would have to be taken into account, as the service provider needs to retain smallholders as clients and preferably keep adding more. This topic of smallholders as 'true clients' is also discussed in one of the G4AW podcasts: 'Space for Food Security, does it work'?'[1]. The fact that this indeed works can be seen from the rapid (user-based) addition of new features such as online marketplaces and online chat features with extension workers as response to COVID-19 imposed restrictions (part 1 Lessons learned).

A final reason for the focus on sustainable business models is that it was expected to attract a new type of partner organisation and technology and service-oriented (start-up) businesses in particular. There is generally a difference between project-oriented companies (research, consultancy) and product/service-oriented companies (IT domain, such as application and platform developers). Product-oriented companies are seen as a crucial player in G4AW, as they have experience with digital design and can ensure a good user experience. These parties are generally not interested in working on a short-term project basis, as their business model is based on selling licences and providing local product support.

Product-oriented companies do not only include the (often Dutch) remote sensing companies, but also the companies that have the connections in the field, where they deliver the services to farmers (e.g., Village Link, ImpactTerra, Auxfin, and different newly created social enterprises). The development of a sustainable business model would also entice these companies to enter new markets and/or to include new technologies in their portfolio.

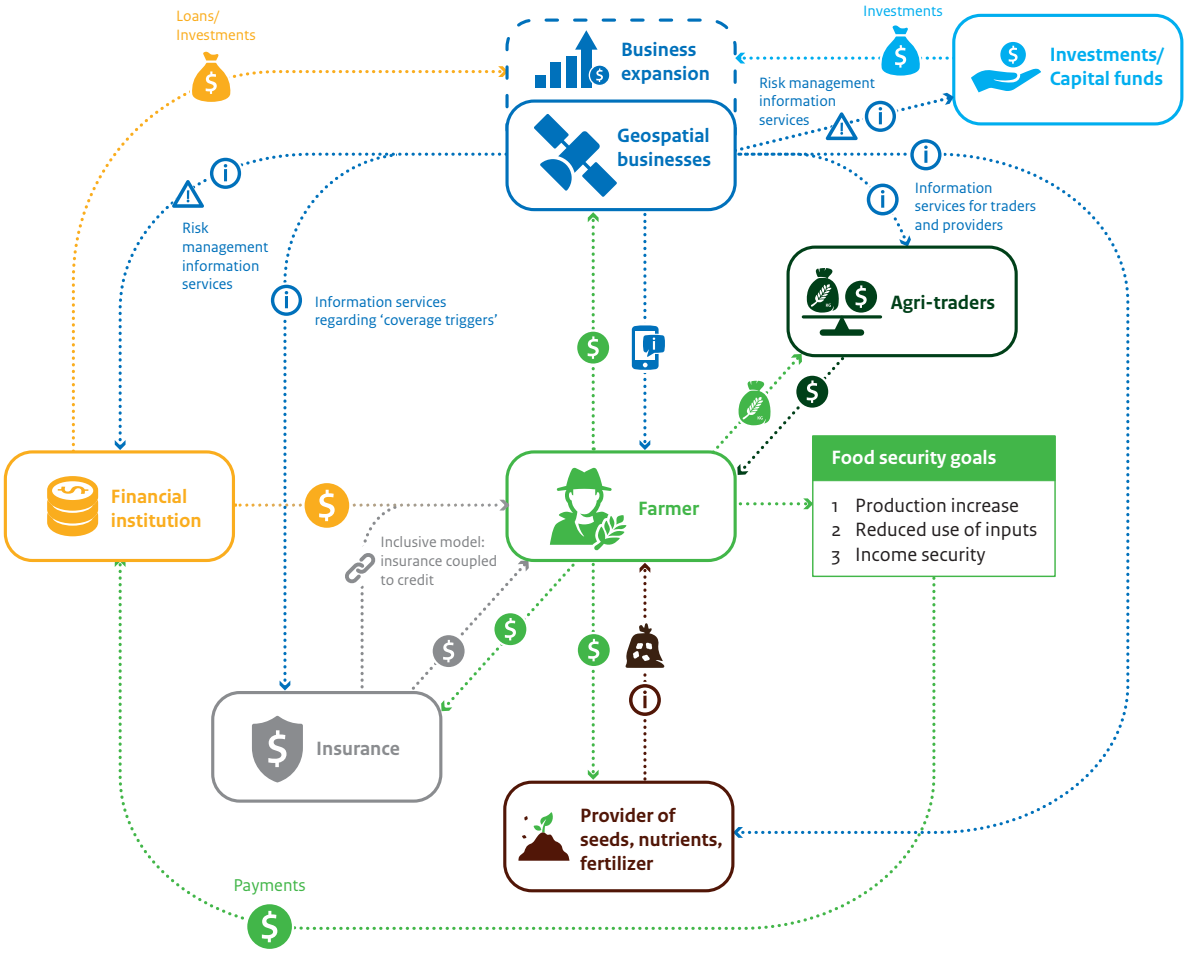
The G4AW Facility indeed has empowered smallholders and attracted many new innovative companies to the domain of digital advisory services for (smallholder) farmers. The main challenge still lies with the most important objective: to build sufficient trust with farmers so that they can improve their livelihoods and food security by continued use of the G4AW-services. Most of the projects that already ended continue to provide services in a certain way, and for the other projects we still need to wait a few years to find out how sustainable they are. There are indeed very promising developments that indicate (demonstrates) the potential for long-term sustainability.

G4AW Framework

To understand all possibly relevant flows of tangible and intangible assets, G4AW has developed a simplified framework (see Figure 1) from the perspective of the farmer indicating products and services (providing benefits for clients) and income streams of involved stakeholders. Aggregators (companies that are already providing services to farmers) have been crucial in this framework, as they already have access to the smallholders and are often willing to bundle new services to improve their service offering. This business to business (B2B) model has been key in creating a sustainable business model in most of the G4AW projects. The previous lessons learned publication has focused on the type of services developed and the information flows.

1 *Podcast | g4aw.spaceoffice.nl*

Figure 1: G4AW Framework with flows of information, commodities and cash



This publication will focus on other aspects, such as business models and finance. As the framework shows, smallholders can potentially pay for services in many different ways. This framework is based on existing exchange mechanisms between smallholders and different kind of businesses. The new services are added to the arrangements that are already in place to achieve cost-effectiveness. The most straightforward way of doing this, would be by paying a fee to the geospatial businesses to receive a certain advice, but experience has shown that in practice the situation is more complicated. This document will provide some of the practical experience with the provided framework.

1. From partnership to entrepreneurship

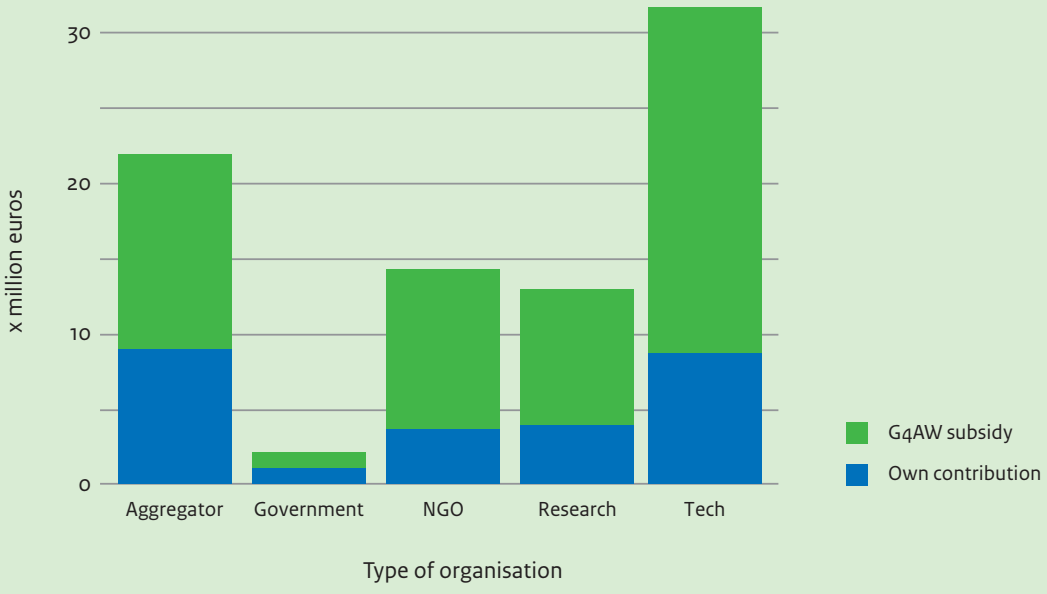
All G4AW projects started with the evolution of existing partnerships or the creation of new partnerships. In the context of G4AW a partnership was obliged to include both public and private organisations; as well as a minimum of one organisation based in The Netherlands (in first two calls often the liaison to NSO as donor) and at least one organisation in the target country. The average number of organisations per partnership (as provided in the proposal) is around five, although on average over seven different organisations have received or provided support in each project. A lot of these additional organisations are subcontractors that contributed in areas that were initially not considered. Each partnership is unique. Each partner and subcontractor had a role to play and had to decide in what form they wished to continue after project ends. This section will discuss the partnership roles, the type of partnerships, the structure and performance of partnerships in G4AW, and the transformation from a partnership to a team of entrepreneurs.

1.1. Public-private partnerships (PPPs)

It is too early to provide a clear success formula for G4AW when it comes to sustainable service provisioning. At the start of the G4AW Facility, it was perceived that public-private cooperation would be needed to successfully develop, implement, and operate advisory and financial services for smallholder food producers. Support of governments was seen crucial to be granted licence-to-operate for service provision including applicable data policies, weather data provision, financial service provision. These public institutes in the partner countries also have local connections that could help the partnerships overcome new emerging challenges.

Figure 2 shows the total funds (and own contribution) of the five main types of organisations involved in G4AW (research, NGO, aggregator, tech, and government). This shows that by far the most funds have been allocated to the tech organisations,

Figure 2 Distribution of funds and average own contribution of different organisations inthe G4AW Programme



Smallholder community in Burundi explores AgriCoach app ©Auxfin International/G4AW GAP4A project

followed by the aggregators. NGOs and research organisations have received around equal funds in G4AW, while the government organisations have received very little resources. They have often contributed in-kind and have been able to capitalise these costs as own contribution. The differences in total contribution can partly be explained by the country in which the different organisations are based. Most tech companies, for example, are based in The Netherlands, which can be linked to higher labour costs.

1.2. Roles and agreements in G4AW partnerships

Every cooperation, every partnership needs structure. It is important that all partners agree on common objectives and their respective roles and formalise these, if required. Important questions to be answered relate to the terms of engagement:

1. What are the collective goals and targets?
2. How are responsibilities divided?
3. What is the timeframe for collaboration?
4. What (formal) agreements do we need/want to develop?
5. How will our teams collaborate?
6. How to deal with (transfer of) intellectual property, intelligence and technology?
7. How will we evaluate success?
8. What are the partnership risks and how do we mitigate them?

Every G4AW partnership has supplied with the grant application a Partnership Cooperation Agreement that covers many of these aspects. This includes information on the shared objectives of the partnership, the expertise of each partner and the synergy, the timeline, the modalities of the collaboration (also specified in the work packages and activities, e.g., to indicate who is responsible for achieving specific results), the way in which parties can claim intellectual property rights, obligations on issues such as formal reporting, monitoring and evaluation, and notice of resignation and termination. What was not included in the most PCAs, but could be useful in future projects, is information on a) how success will be evaluated for the

partnership, and b) how the partners want to continue after the project (based on whether they evaluate the project as 'successful'). This is because the process of establishing a potential new enterprise takes quite some time and resources. If this is already considered in the early stages (exit strategy) and is based on clear targets, this will facilitate the transition to a sustainable business.

The BopInc survey found that in 86% of cases, a partnership partner was excluded from the future business case, for reasons such as: (1) their role was focused on development of the innovation which is not relevant anymore now that the service is developed, or (2) they have lost interest in participating in commercialisation, or (3) they are replaced by a more affordable service provider. For 67% of partnerships, the business owner mentions that Intellectual Property Rights have been clarified and agreed upon by partnership partners. Most of the remaining 33% of projects appear to be at a low commercialisation readiness level, meaning that (1) the service may not be fully developed yet, (2) there was little attention for operational agreements or (3) the partnership lacks interest to continue with the service.

1.3. Partnership roles

A healthy partnership has to be rewarding to all partners involved. This means each partner has to give and take to create a shared value. It is important that the partners identify a resource or asset they can bring to the partnership, which can complement or enhance the resources or assets of other partners. Different tangible and intangible assets that can be used to improve the output of the project are shown in Table 1.

Different types of organisations bring in different assets. For providers of satellite data, this is generally technology, knowledge, and patents. For local public partners this is the strong local network, connection to farmers through extension officers, access to local data, and relationships with other government agencies (e.g., for licence to operate purposes). Research organisations bring agronomical knowledge (e.g., crop calendars, agronomic model, information on pest and disease) needed for analysis and generation of advisory services.

As finance is the main bottleneck identified by most G4AW partnerships in the survey by BopInc in 2020, the main focus is generally on finding new partners that can help with this after the project funding will come to an end. Most partners are not yet looking for direct investors but rather for organisations that can help them reach scale and sell more products. Organisations are also often reaching out to grant programs for further validation, scaling up, and introduction of developed services in other countries. Few have been in contact with actual (impact) investors yet. By not doing so, partnerships might miss the opportunity to have access to the advice and networks of these investors.

1.4. Structure of partnerships in G4AW

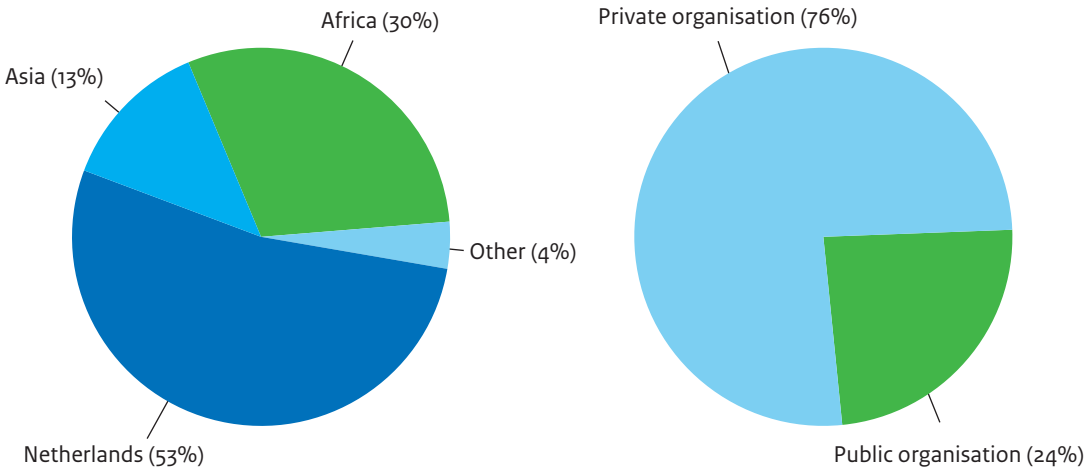
The 25 G4AW projects include 182 partners[2] in total, 126 of which are unique (status summer 2020). Partners are distributed relatively evenly over The Netherlands (53%) and Africa/Asia (43%). Other partners have residence in France, the United Kingdom, Switzerland and the United States (total 4%). Of the total (non-unique) organisations involved in G4AW, around three-quarters are private partner organisations and the rest are public organisations (see Figure 3). Public organisations mainly include research institutes and universities (agriculture and remote sensing)

Table 1 Relevant assets for partnerships (green = relevant for G4AW).
Adapted from the BopInc presentation on partnership brokering for G4AW partnerships (Nov. 2020)

Tangible assets	Intangible assets
Land	**Networks, relationships with government**
Technology	**Media (communication channels), etc.**
Infrastructure	**Patents, copyrights**
Buildings, plants	**Knowledge, skills**
Machinery	**Reputation, goodwill**
Finance	**Scale (channels, customers)**

2 *In this analysis only the organisations that signed the Partnership Cooperation Agreement were taken into account. Locally contracted SMEs and NGOs are excluded from this analysis.*

Figure 3 Distribution of partners between regions (left) and between the public and private sector. Locally contracted SMEs and NGOs are excluded from this analysis.



and agricultural ministries/departments in the target countries. Other public organisations include research institutes focused on weather services and rural economics.

The private partners are much more diverse, and consist of some general groups: providers of satellite data, data integrators, (local) data collectors, NGOs (considered private partners in the context of G4AW), social enterprises and aggregators (agribusinesses, telecom operators and financial institutions). Many of the additional organisations that have received funding are not formal partners in the projects, but have played a certain (temporary) role. These are mainly IT companies in the partner countries that have helped in app or website development, or were specialised consultants hired from other countries for their specific thematic expertise.

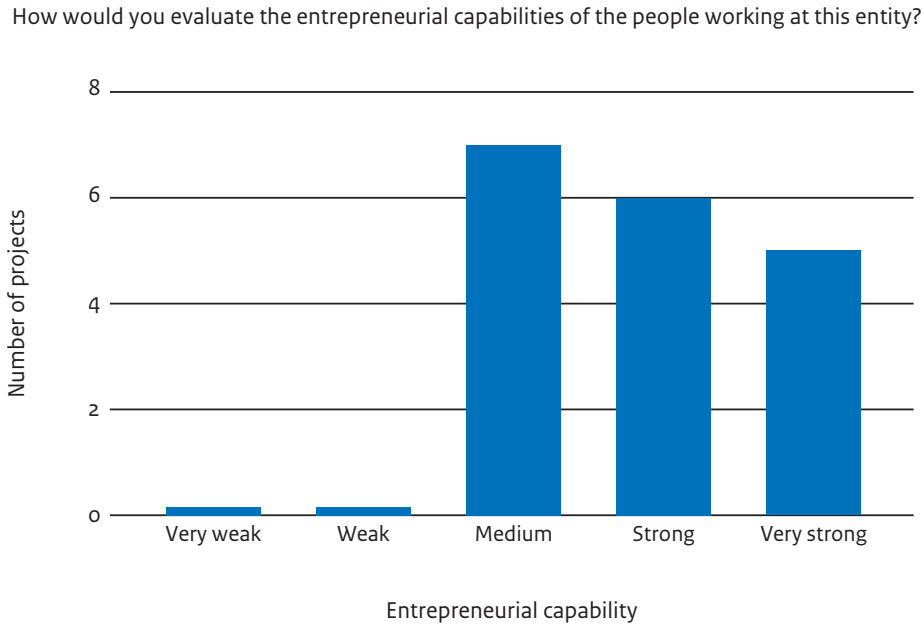
1.5. Performance of partnerships

The 2020 BopInc survey focused on several aspects related to partnership satisfaction and performance. In this survey, all respondents (business owners) are satisfied with how the project partners can help interact with large groups of farmers as they scale their service. All but one reported they have a project or business partner that has the necessary network or channels to reach the customers that (are foreseen to) pay for the service. The partners with these capabilities range from NGOs, national farmer organisations, government bodies, to commercial enterprises. Similarly, all respondents except for two reported they have a project or business partner that can interact with the large groups of farmers that benefit from the service.

Over 85% of respondents reported that their partnership has agreed on who will lead commercial sales of the service developed together. In most cases this is a social enterprise or for-profit company, taken care of by a party that was already part of the original partnership. In a quarter of the G4AW projects, the business lead is a newly identified party that was not part of the original partnership or a newly established business entity by the partnership itself.

In all cases but one, the organisation that takes entrepreneurial leadership was already doing business with the target group of the service. This organisation was often already included in the partnership from the start of the project, but in some cases was also involved at a later stage. However, despite their former experiences, seven of the respondents indicated that this entity still needs to further develop the entrepreneurial competences of their team for the new service to be successfully sold among the defined target group. The entrepreneurial qualities are currently considered from medium to very strong. See Figure 4.

Figure 4 Self-evaluation of the entrepeneurial capabilities of the business lead



1.6. Type of organisations in G4AW PPPs

The perspective 'beyond the project' is very important in G4AW. Therefore, in order to assess the business case, it is important to understand the partners in the project. If the business case seems solid, what is the likelihood that the services will continue to be offered after the project? To be able to answer this question, a responsible "business owner" must be identified and their motivation must be understood. There are five general types of organisations involved in G4AW: research institutions, NGOs, agribusinesses, IT companies, and public sector institutions.

Project lead vs. business owner

Project lead is responsible for realizing the main project goals when it comes to impact and deliverables. The business owner is responsible for service development and delivery and will remain important after the project has ended. This is the challenge of G4AW partnerships to organise both well, as business development is often still a relatively new task for many of the involved organisations.

This section discusses why these different types of organisations have become project leads and/or "business owners" in G4AW and what their strengths and weaknesses are based on the experience of G4AW. There has been a clear shift in the type of organisations that were dominant in taking the lead in the different calls of G4AW. In the first call of G4AW a lot of research organisations were involved as lead, which means the knowledge-related assets were very well represented. In the second call, NGOs have taken a more prominent role as leads: they bring in knowledge of food producers and farming activities, trust, goodwill, and generally also media skills. The third call of G4AW has received more interest from business partners as leads. These are stronger in entrepreneurship, finance, and scaling up.

1.6.1. Research institutions

This includes for-profit and not-for-profit organisations, such as consultancies, research organisations, and academic institutions. The main characteristic is that their business model is building a knowledge base and, in some cases, selling this knowledge through consultancy assignments. Examples from the Netherlands include WUR, ITC and Deltares. In G4AW partner countries, these are often (agricultural) universities and other research organisations, for example: Interdisciplinary Centre for Food Security (ICF) at Bangladesh Agricultural University

(Bangladesh), World Vegetable Center (Cambodia), KALRO Sugar Research Institute (Kenya), ARC (South Africa) and others. In most cases these are public organisations (universities), but there are also some private organisations that focus primarily on research and consulting.

Knowledge partners are often more interested in the role of supplier (supply of data, knowledge / providing consultancy on an hourly basis) than in a role of aggregator or exploiter of a business. Sometimes knowledge institutions may have a share in a (social) enterprise. In G4AW such a construction was not observed.

Research institutions are often closely linked to the public sector, resulting in a strong network and the possibility to work with the government extension system. Many of the Dutch research institutions are already familiar with working on development projects. This means that they often have an established network of partners in different countries, which can help with finding the right business partners to become the owner of the services.

For research institutions, PPP projects are primarily an opportunity to improve and market the available scientific knowledge and simultaneously create a positive impact. Even though knowledge parties may see a role for themselves as supplier in the chain, it is unlikely that they will put much effort in building an operational data chain just to become a supplier. Role of research institutes and private sector should be clearly defined before starting project execution.

1.6.2. NGOs (non-governmental organisations) and social enterprises

These (not-for-profit) organisations are generally acting in the area between the government and private sectors. They often have a strong network with both the Dutch public sector as the public sector in the partner country. The focus in the context of G4AW is primarily on improving the livelihood of smallholders and only secondary on creating revenues. These types of organisations are often able to find additional sources of donor funding that enables them to bridge the financial gap when the project ends after 3 to 4 years, giving them more time to scale the project and create a sustainable business model. Some examples from G4AW include ICCO (now Cordaid), Solidaridad, SNV and WorldVision. Examples of social enterprises include FarmGrow (Sat4Farming, Ghana), Kres (Mavo Diami, Angola), SIPINDO (SmartSeeds, Indonesia), SpiceUp (SpiceUp, Indonesia).

NGOs were largely absent as project leads in round 1 of G4AW, but entered the scene in round 2 of G4AW. Over the years, many NGOs embraced digital technology as a means to reach a greater impact, some NGOs even included digital technology in their corporate strategy and actions to mitigate the risks of COVID-19[3]. As a direct consequence of substantial (rural development focused) NGO involvement in round 2, the focus of application of geodata shifted from insurance (geodata supplied to insurers in support of index-based insurance for farmers) to information services directly delivered to the farmers (e.g., Good Agricultural Practices, GAP).

The strength of NGOs is the drive and the (local) network. NGOs generally have been active in partner countries for many years, and have often worked on different projects with the same focus in the same areas. This makes it easy to find the right public and private partners. NGOs often have good connections in the public sector and have a certain goodwill factor both in the Dutch public sector as with local government agencies. Another strength related to the non-profit and impact-based nature of the work is that it is generally quite easy for NGOs to find additional sources of funding. This can help them to scale the services, link them with other activities, and bridge a longer period before breaking even.

The main focus of NGOs is to help the poor. Digital tools are increasingly seen as important part of the approach of NGOs to help the smallholders. The focus on a sustainable business model is mainly a focus on creating a continued service offering that help smallholders in the long run. This means that there is certainly a focus on creating a sustainable business model, but is the profit motive is not as strong as for the private sector companies.

1.6.3. Agribusinesses, financial institutions

These are for-profit organisations. Usually risk-taking by having invested in assets (e.g., building a stock, invested in developing a platform). They have a direct relationship with farmers and generate earnings based on this relationship. G4AW services can be used to reach more farmers to sell products. It can also be used for better planning of marketing activities (e.g., finding suitable areas for certain seeds) or profile farmers to

3 https://www.nlfoodpartnership.com/comm-of-practice/covid19/covid-19-cop-digital-solutions/

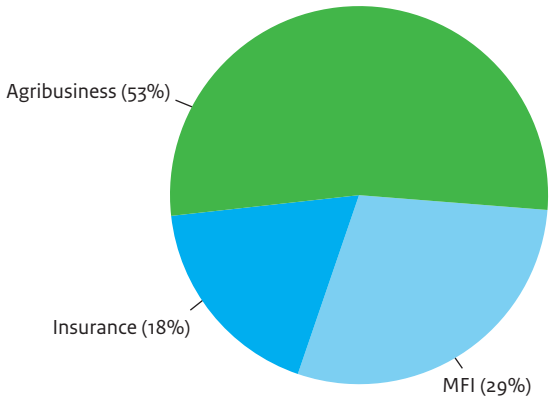
de-risk investments (for MFIs). For these commercial organisations, G4AW creates value in different ways. Primarily, this improves their business offering by improving marketing, reaching more farmers and better understanding of their customers. In addition to this, the services can contribute to the corporate social responsibility.

Some agribusiness involved in G4AW include, amongst others, ACI, LalTeer (Bangladesh), AngkorGreen (Cambodia) AWBA (Myanmar), EWINDO (Indonesia), LocTroi (Vietnam), Touton (France) and Verstegen (Netherlands). Some financial institutions involved in G4AW include several MFIs from Ethiopia, Equity Bank (Kenya), Jasindo Insurance (Indonesia).

In G4AW, 34 of the partners fall in this category. Around half the aggregators fall in the 'agribusiness' category, while the rest are financial institutions focused on either micro-finance or insurance (see Figure 5). The agribusinesses form a very diverse group that includes large and small organisations involved in provisioning of agricultural inputs, but also in international trade of high-value agricultural commodities.

For many of these companies, involvement in G4AW is not only about growing, but also about becoming more 'responsible' in their activities. For this reason, there is often a clear focus on linking the services to corporate social responsibility. Compared to research institutions and NGOs there is clearly a stronger focus on the business model, as this is intrinsically linked to the existing business offering.

Figure 5 Types of G4AW partner institutions



Many aggregators already have a large customer base, a network of extension officers, understand farmers' needs, can test products, and understand how to best package information to make it valuable and actionable for farmers. Agricultural input providers most likely will pick up the development costs, because they know that sooner or later the service will translate into a growing business. For them, the G4AW project is a stepping stone. Aggregators are often larger companies with sufficient budget that can be spent on new developments. They can make a significant own contribution.

A business must first and foremost see potential in a service or product. The service should have a value proposition and be beneficial for their clients ("a gain relieving a pain"). Only when the business potential of the new service or product is clear can one assess if the perceived benefits of service provision justify the development and operational costs.

1.6.4. Tech companies and mobile network operators

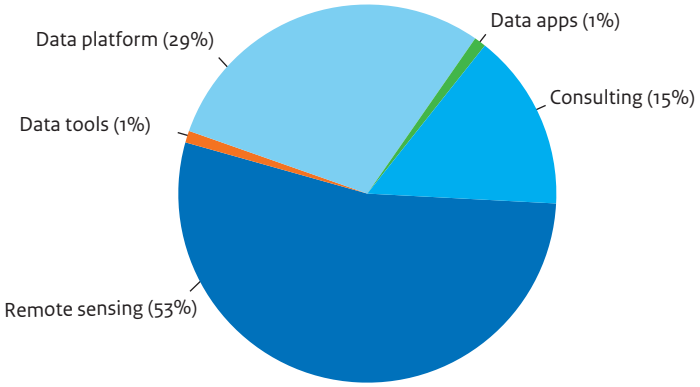
These companies create most of the actual services in G4AW, or facilitate distribution. They often lack the underlying agronomic knowledge and local networks to act alone, but have the technical experience to create an operational service that fits the demands of farmers. These companies play an important role, but are rarely in the lead (only in two projects). The main interest of these companies is to sell operational services based on a certain licence to have recurring income. Many are new to the kind of projects as implemented in G4AW and face challenges with project management. Some of these companies are also social enterprises with a not-for-profit objective, although many are still 'traditional' for-profits. Several are joining in the created social enterprises in G4AW. Some local tech companies involved in G4AW include mPower (Bangladesh), Kifiya and Apposit (Ethiopia), Esoko (Ghana), VillageLink (Myanmar). Some mobile network operators involved in G4AW include Orange (Burkina Faso, Mali), SMART Axiata (Cambodia).

The tech-companies (geo-ICT) are the largest group in G4AW. These include the actual remote sensing companies, but also providers of data platforms and related consultancy. In G4AW, 72 organisations can be included under this category. The largest group of tech companies are remote sensing companies (53%), followed by data platforms (29%) (see Figure 6). The category of consulting firms includes companies that assist the tech companies in project management or provide other relevant advice to improve the services.

By far the majority (79%) of the tech companies is based in The Netherlands. For remote sensing companies

this is 100%.[4] This is the result of the key strength of the Dutch private sector that could contribute to improved food security in the partner countries, and the short connections with Dutch NGOs and knowledge and research organisations. At the time when G4AW started (2013), apparently there were also very few companies with such remote sensing expertise in the partner countries, although this has rapidly improved over the past decade. The tech companies in the partner countries mainly provide data platforms and operational support to ensure local embedding.

Figure 6 Types of tech companies involved in the G4AW programme



For most of the tech companies, remote sensing products or services and creation of data tools are part of their core activities. Some companies have a strong idealistic drive and only focus on issues related to SDGs, while others have a more general market-oriented focus and follow the demand. Within the tech companies, there are large differences between project-oriented companies and companies mainly focused on selling licences and providing operational support. Most of the remote sensing companies are still project-oriented, while most of the companies that create data platforms are focused more service-oriented on generating income through selling licences (product-oriented).

The strength of these tech companies relates to all geo-ICT technical developments required. They have experience with app creation and design, testing and debugging, finding and linking relevant data flows, and, in the case of remote sensing, actually converting the raw satellite data into actionable advice. With tech procurements, they often also create the operational system, including front-end and back-end, and the support system to ensure all flows of data and information products remain functioning. Most of these companies have worked on digital advisory tools before, although this was often not for smallholders.

Having a certain percentage income from service provisioning results in more room for tech companies to invest in continuous improvement of the tools. The tech companies are very flexible. They are generally not bound to a certain geographic region or the agricultural market for their technical products and services. This means that any investment in their technologies potentially has wider benefits if they can find the right partners to market the products. For this reason, these tech companies have become involved in G4AW (often in more than one project), and have a relatively high own contribution.

1.6.5. Public-sector institutions

Public sector institutions involved in G4AW are mainly directly related to the agricultural sector (e.g., ministries of agriculture), although in some cases these are national meteorological organisations. Their main interest to be active in G4AW is to contribute to their institutional objectives, which often concerns increasing the agricultural production or providing better weather information. This can be achieved directly by providing advisory services, but also by subsidising crop insurance. Some public-sector institutions in G4AW include: KNMI (Netherlands), National Meteorology Agency (NMA) of Ethiopia, South African Weather Service (SAWS), BMKG and LAPAN in Indonesia.

The role of the local government has been very important in G4AW. The government will provide all necessary licences. This includes the general licence-to-operate, but also more specific licences on certain activities (e.g., conducting supporting field campaigns or drone flights). The government can help the partnership by providing access to their network to link existing extension activities with G4AW activities. At the same time, the local government can create limitations, such as by creating new legislation related to data privacy, which means the partnerships need to make significant changes to the existing data infrastructure midway a project. An active and constructive involvement of the local government seems to be a prerequisite for success. This can make or break the services.

The role of the government is not only to facilitate achieving project goals in the short-term, but also in the long-term. An example of a success: the project SUM Africa in Uganda with a Dutch project lead (service provider) turned into a success

4 *Before opening round 1 and 2 of the G4AW programme workshops were held in G4AW partner countries to identify potential partners and allow match making. Relatively very little local geo-ICT organizations were identified in the period 2013-2015 and participated in the workshops. This explains the absence of such organizations as G4AW partners. Anno 2021 this landscape has changed dramatically: in many G4AW partner countries geo-ICT organisations have been established. In various G4AW projects local SMEs and/or geo-ICT became involved as subcontractor to a G4AW partner.*

thanks to the efforts of NUCAFE, an aggregator (coffee grower association), and ARC (Agriculture Reinsurance Consultants), a local insurance company. They made a big effort and succeeded to inspire the government of Uganda to provide a 50% subsidy on the insurance premium for a few years. By the end of 2021, local insurance companies insured two hundred thousand farmers.

In Mali, the SUM Africa project failed for opposite reasons: the government wanted to levy an insurance tax on the premium, thus making insurance too expensive, instead of providing a subsidy to make the product affordable for farmers. Another product that was created to validate insurance claims in Indonesia (G4INDO) also faced some limitations: while there was active involvement of a government agency, the partnership continued to face the limitation that each significant insurance claim had to be verified in the field. The key benefit of the created service was that this could be more effectively done with satellite imagery by sending the field officers to the locations where most damage occurred, helping farmers that suffered most first.

In the long term, government involvement can help support the overall enabling conditions for services. This includes network access, inclusion of digital tools in extension programs and interoperability between countries. For example, the SNV-led MODHEM (Burkina Faso) and STAMP (Mali) projects continue to expand and have continued in a new phase with Dutch and Swiss embassy support. In addition to this, a new and similar service is being created in Niger. In order to ensure that these programs contribute to the same objectives, and to ensure that pastoralists can be reached in remote areas and when they travel across borders, there is an increasing focus on policy dialogues with the relevant stakeholders in the different countries. Ministries (focused on livestock and agriculture) were already involved in the initial projects, but this interaction is expanding to other ministries to ensure issues such as network coverage are also being addressed. This can help the services become accepted and promoted throughout the Sahel region.

1.7. Transition from partnership to entrepreneurship

The step from a partnership to a business is very challenging. The partners either need to select one of the existing project partners to lead the future operations and commercial sales or organise themselves in a new format (e.g., social enterprise) in which they can reach out to customers (B2B and/or B2C customers) and deliver the services.

Almost 90% of partnerships have agreed on who will lead operations and commercial sales. In 80% of cases, this is a social enterprise or for-profit company. For 75% of projects, the leading party was already a member of the partnership. Six of the business owners are at sizes of micro (less than 10 staff members), three are small (less than 50), one is medium (less than 250) and three are large (above 250). In four cases, this business lead is a newly identified/established entity. This number is expected to increase: in 2021, eight partnerships were finalising their business agreements for the post-project phase. In 70% of the cases, the entity that took the business leadership was already doing business with the target group of the service.

1.7.1. Value chain aspects

Some value chains are more developed than others, which partly depends on the crop and region. For crops such as rice, cacao, coffee, tea, pepper there will be many powerful players in Asia that could become the business owner. This includes traders, seed companies, fertilizer and pesticide companies and more. At the same time, the rice value chain in Africa is much less developed, and for other crops the value chains remain quite local. One of the exceptions in Africa is the coffee value chain (G4AW projects in Kenya, Uganda) and the cacao value chain (two G4AW projects in Ghana). They are well developed.

Some partnerships came to realise that value chains were not well organised, with different stakeholders in the supply chain struggling with a variety of problems. The SIKIA project in Tanzania faced a fragmented value chain with many different stakeholders, making it challenging to find the right partner. Most G4AW partnerships have recognised this and have started to search for a bundling of services to address multiple problems in the value chain. Large corporations generally cover quite a lot of the value chain and understand the different challenges. When focusing on agronomic advice, it will thus be important to include partners with a deep understanding of the value chain that will be covered.

1.7.2. New partners

New partners are frequently added to fill gaps that the partnership has encountered. This includes partners that provide specific IT skills and/or local context. In some cases, they can create new services or use their

Margret Kigozi, farmer in Uganda, SUM-Africa ©NSO/G4AW

networks to market the services. In the BopInc survey, over 90% of respondents mentioned that they have established new partnerships with organisations that were outside the original partnership. These include large commercial organisations, such as input suppliers, breweries, financial institutions, mobile network operators, but also large (international) institutional organisations. Most new partners are, however, smaller specialised partners focusing on issues such as marketing and website creation.

The BopInc survey found that there were various reasons why these new business partners were onboarded by the G4AW partnerships, ranging from the opportunity the new partner helps scale up regarding the service, bundling the service to assisting in last-mile service delivery and adding financial services to the portfolio. New partners, in particular, that could help the existing partnership with creating services that would make them more relevant for financial institutions (e.g., farmer profiles, credit risk scoring) were in high demand: 5 out of the 6 partnerships involved in the partnership brokering part of the in technical assistance project indicated that they were looking for such partners.

Various respondents in BopInc survey mentioned they are still waiting for their "dream partner" to join. A dream partner is an entity that can, like no other, help realise the project's ambitions. The dream partners mentioned are typically scaling partners, which include large input producers, financial institutions, large agribusinesses as off-takers, large telecom operators, or large corporate or governmental institution.

> *"Dream partners would be large commodity traders and international microcredit providers. Because climate risk management products can then be built into the value chain at a higher level and provide automatic coverage for millions, at lower operational cost than in-country initiatives".*
>
> **SUM Africa (Uganda, Mali)**

1.7.3. Project transition strategies

Ideally, the partnerships need to make sufficiently clear how the positive impact will last once the project ends by providing a clear project transition strategy. In the case of G4AW Facility, the exit strategy falls into a special context. G4AW is primarily focused on the development of products and services, not short-term projects. In the G4AW context, the requested exit strategy was primarily a strategy to be able to continue activities (and possibly scale them up) without support from the Dutch Ministry of Foreign Affairs.

The most important exit strategy from the G4AW projects is the focus on a sustainable business model. If the partners can find this during the project by developing the right services and finding a good business owner and business model, in many cases they will be able to continue sustainably. In order to continue providing services in a sustainable manner, a number of issues are important. These include the (cost) optimisation of services, organisational embedding, involving end-users (user needs, customer satisfaction, feedback on products and services), finding the right partners, and developing capacities for good entrepreneurship. Discussing how the risks are distributed between partners is crucial in this step as well.

The projects within G4AW generally - and unsurprisingly due to the programme objectives - have a strong focus on the social aspects: how to help as many food producers as possible. Several of the partnerships continue as (often newly created) social enterprises. The focus in many of these partnerships is to provide a financially sustainable service and not on profit maximisation by a single party. ICCO (now Cordaid) has created, or is in the process of creating, new social enterprises in several G4AW projects in Asia. The merging of several partners into a social enterprise is a frequently chosen exit strategy. This involves transferring the services to a local company in which one or more employees from the original partnership will work. The knowledge and the network are thus secured, while it also becomes possible for other partners to leave or to remain involved in operations in another form, e.g., as a data supplier.

Often, the technical parties provide their services at a reduced rate until the services are profitable (or to a maximum of x years). After that, the technical parties often receive part of the income from the services. For technical parties, continuing involvement might also help to enter new markets, and use the existing network and experience to market their 'core' products that fall outside the scope of G4AW. In a number of projects, local service providers take over the services (e.g., MUISS, SUM Africa, STAMP, MODHEM). However, in a number of projects, the establishment of a company was investigated, but not carried through (CropMon, Sat4Rice, R4A), or has not been effective (yet) (GREENcoffee, SIKIA). This was due to a lack of entrepreneurship, business partners and/or financial resources.

1.7.4. Challenges to the partnership

G4AW partnerships have faced many different challenges. Most of these are unique for a given partnership. This included partners that went bankrupt and partners that underperformed and had to leave the consortium. In most cases, the partnership solved these problems with redistribution of tasks among other project partners, or by contracting external suppliers. Some more common challenges in G4AW relate to the strict project timeline constraints in combination with ambitious objectives, as well as the balance between public and private partners. This balance is also related to the role, funds and objectives. A few of the challenges are elaborated below.

Ambition

The introduction of new technology for a target group that is difficult to reach, the establishment of a (relatively) new partnership and the successful implementation of a successful business case are very ambitious objectives to reach in a period of three to four years. The initiators of G4AW, aware of these risks, still decided to publish G4AW Facility in 2013 with its ambitions and challenges, and to learn about the market response, creativity and business developments. In addition, the project applicants stepped into this new arena with a lot of confidence.

However, the need and necessity to develop and operate G4AW-like services is reconfirmed by Global Commission on Adaptation with the Action Track Food Security and the Blueprint for investment in Digital Climate Advisory Services (DCAS)[5]. The ambition set by GCA is that 300 million food producers in Africa

5 *A Blueprint for Digital Climate-Informed Advisory Services: Building the Resilience of 300 Million Small-Scale Producers by 2030 | World Resources Institute (wri.org) https://www.wri.org/research/digital-climate-informed-advisory-services*

are digitally connected to such services. This ambition is 100 times the original G4AW ambition. The G4AW programme as such can be seen as an early adaptor programme for GCA DCAS. The very good news is that GCA and African Development bank are joining forces in the African Adaptation Acceleration Fund – AAAP, a new programme with funds to continue development and scale up of DCAS services in Africa.

Product development

During the project execution, the (high) expectations of the partnerships were generally tempered. Most business leads struggled with the development of an appropriate value proposition, a product or service that would sell. Some of the reasons are:

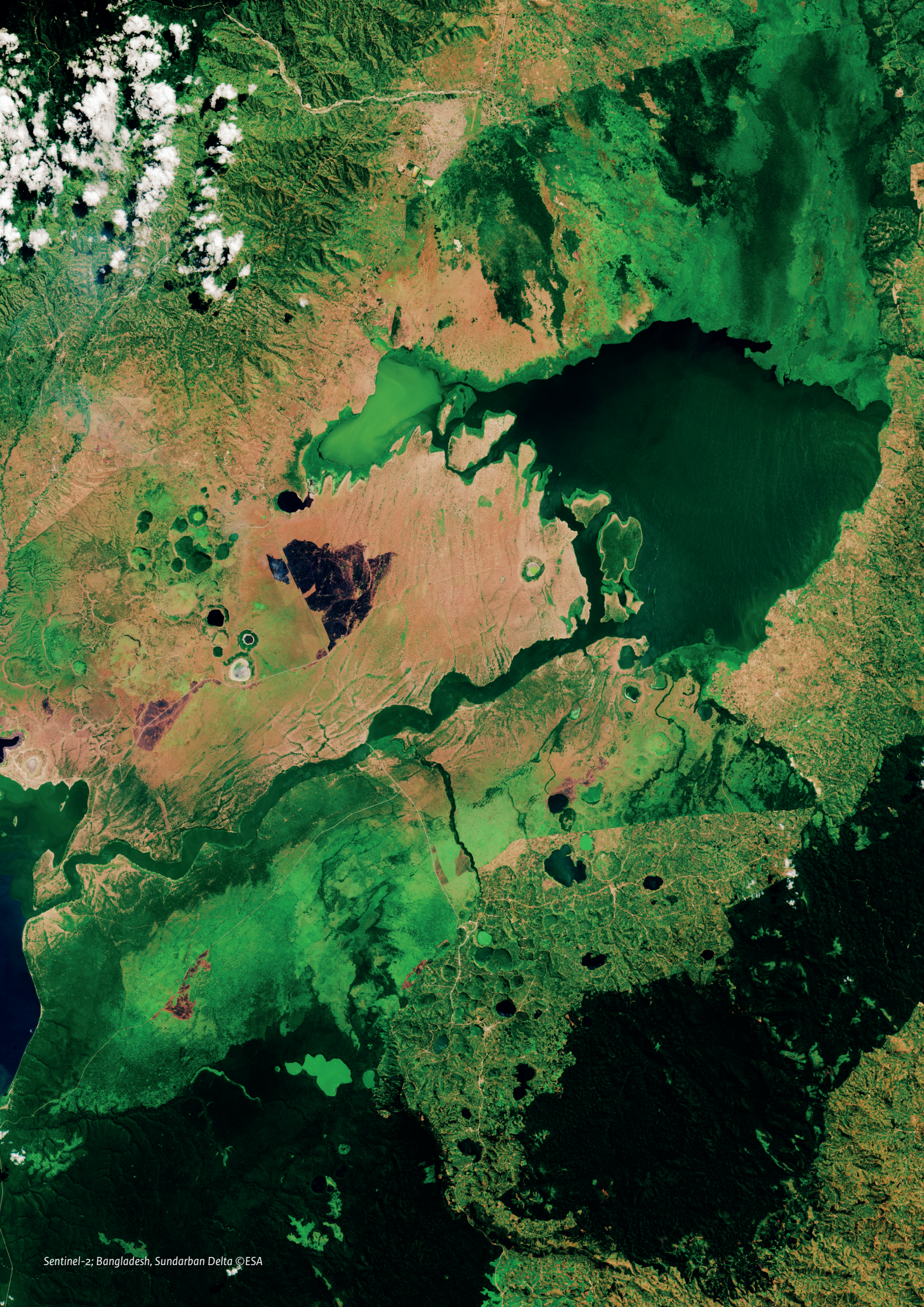
- The farmer obtains multiple types of information from many organisations and is therefore difficult to reach with one information product. Therefore, the trend now is to offer an information package to the farmers (via an app), whereby the geodata based services is one piece of bundled information only. It is noted that some G4AW projects were successful in providing single information products (e.g., GEOPOTATO, an alert service to fight Phytophthora in Bangladesh; SUM Africa, an index-based insurance scheme for Uganda).
- Providing information is one thing, but making it actionable is another. The information might not be specific enough for that farmer, the farmer does not have skills or finance to follow up, or the product (e.g., pesticide) that was advised is not locally available. Or, in other words, how useful is information if there is no opportunity for follow-up? This was the case, for instance, in Kenya with the Geodatics project: the recommended fertilizer blends were not locally sold.
- Specific information about the local context of the farmer is often unknown (e.g., where exactly is the plot of land, what is the crop?). This lack of context hampers the provision of accurate information. Therefore, in general there is a growing attention for obtaining information *from* the farmer, rather than providing information to the farmer only.

Revenues

In projects where 'minimum viable products' or services are available, the issue of willingness to pay arises by smallholder food producers. In most projects, the practical willingness to pay was low or zero, even when earlier market studies reported that clients were willing to pay for service provision. Reasons for this include amongst others: 1) the service does not meet the client's expectations, 2) similar services are offered by other (donor-funded) projects for free, 3) the service has not proven to be beneficial within the project timeframe. In few of the G4AW projects there is a clear willingness or capacity to pay for the (stand-alone) service. Examples of G4AW projects where this is the case are: MODHEM, STAMP, SUM Africa, GIACIS, GEOPOTATO.

The conclusion is that many projects have moved away from the initial "B2C paid product/service" idea. Some of them are still contemplating "premium services" (only pay for specific features such as detailed farm-specific advice), others have totally abandoned the idea that the farmer will pay. Premium services include more tailored agronomic advice or access to extension workers through chat. The trend seems to be towards models whereby the farmer (beneficiary) is not the paying customer, but a third party, e.g., an agribusiness or aggregator (e.g., finance, agri-business, cooperative, telecom, off-taker). This shift in approach, from the farmer as customer towards the agribusiness as customer has consequences for the project:

- New products and/or services with a value proposition must be developed for the third party and fit their needs and their data infrastructure.
- It is not about that specific piece of (geodata) information anymore, but the information often becomes part of an existing package of services offered by the agribusiness (bundling).
- If the geodata info is part of an already existing package, then the "licence to operate" generally becomes easier accessible. After all, most of the information is simply added to a service that is already in operation.
- If the geodata services are embedded in a package, the question becomes who will be the business owner.



Sentinel-2; Bangladesh, Sundarban Delta ©ESA

2. Succes of services

Whether the services are successful depends on the point of view of the different stakeholders. Each stakeholder assigns a value to different aspects. At the highest level (Dutch Ministry of Foreign Affairs), the success of G4AW depends on the impact the services have on food security and environmental sustainability. At the level of the implementing agency (Netherlands Space Office), success is linked to the utilisation of satellite data for socio- economic purposes and stimulating innovation. For the partnerships, success depends on both the economic (minimum brake even) and social (SDGs, CSR, conflict reduction) benefits. At the level of the final recipients (smallholders), success depends on the benefit-to-cost ratio (BCR) of the services. In this document, we only focus on the point of view of the partnerships and smallholders[6].

Irrespective of the stakeholder, the service is only a success when it is operational, and continuously used. This chapter therefore discusses the service design and the types of services created within G4AW.

2.1. Service design

In order to reach many smallholders, their needs should be addressed in a satisfactory manner. That means that the provided information should be clear and advice should be actionable, accurate, and inclusive (also reaching marginalised communities, women, and youth). This is based on a continuing user design trajectory promoting digital inclusion. This user design is discussed in part 1 of the lessons learned publications. Users have been actively involved in most stages of the design phase. The main challenges, however, are related to involvement in the early project stages (initial concept) and the impact that the selected service delivery method has on the uptake of the service (see "barriers to service uptake" in the next section).

The G4AW partnerships also had a lot of freedom to select target country, group, crops or other commodities, and more. The only restrictions from the perspective of service design were that the services had to be digital in nature and, at least partly, should be derived from satellite data. It was anticipated that these elements would not create serious restrictions to the business models as a lot of free and useful satellite data was available. With this, partnerships had a lot of flexibility to create lean products with only limited operational costs that can contribute to the building blocks for sustainable business models and provide opportunities for scaling up.

2.1.1. Barriers to service uptake

There are many barriers to the uptake of digital advisory services in the agricultural sector. These are generally related to a limited product-market fit (see part 1). The services need to meet a clear need, and also provide sufficient tools to take action. For example, uptake of nutrient advice will be limited if the recommended fertiliser blend is not available on the local market and farmers will not have access to the finance needed to afford these. Financial access has been identified as an important restriction, and several partnerships have either implemented tools to promote financial access (by adding farmer risk scores to their services to attract interest from micro finance institutions (MFIs)) or are identifying ways in which they can add such features in the future.

Another key barrier to service uptake is related to the service delivery methods. While very basic and easily accessible tools such as radio and basic phones can be used to deliver the services, they generally limit the options for business models. Especially for access to financial services, the more advanced service delivery methods (apps, internet) provide more potential. The decision partnerships have to make in these situations, is whether they want to offer their desired optimum service (for which they see the best business opportunities in the long term), or reach the largest potential customer base in the short term and hope that the business potential can also be met with a more basic service offering.

2.1.2. User stories

User stories (persona) can help identify the needs of different target groups. *What do they need, and how can they pay?* Creating relevant user stories first requires that the

6 *An external evaluation of the G4AW programme commissioned by Dutch Ministry of Foreign Affairs is conducted to identify the success at the higher levels and is expected to be published before summer 2022.*

partnership understands who the potential users are. This group of smallholders is often highly diverse. Age, gender, crops, education, location, and income (among others) are all factors that influence the needs of farmers and their willingness and capacity to pay. In most cases (almost all projects are currently providing their services mainly under a B2B model), the users of the services also include businesses or government agencies.

2.1.2.1. *Smallholder user stories*

Within G4AW, the partnerships have actively involved the smallholders in the design of the services (Working Package User Engagement). There was no fixed output for this working package, and partnerships have dealt with this very differently. Some partnerships have placed a certain commodity and business model at the centre, and have subsequently identified which users they need to target to make this work. Other partnerships have identified different groups of smallholders (farmer segmentation based on local experience of NGOs) and have created user stories for these. User stories generally provide an 'average' for these different segments, including expected needs, digital literacy, economic situation, farm management, and willingness to pay.

The **needs** include a wide range of challenges farmers are facing. In many G4AW projects, the initial main focus was on the farm management activities (e.g., irrigation and nutrient advice, crop selection, sowing date). This is because most early services have focused on providing agronomic advice and weather information. Projects focused on crop insurance and financial access have looked at the overall socio-economic needs of smallholders. The options that smallholders have to solve these challenges depend on a wide framework of socio-economic, biophysical and (IT) infrastructure conditions.

2.1.2.2. *Business' user stories*

User stories are not only relevant for the smallholders, but also for the involved aggregators (e.g., agribusiness, MFIs) as these are generally expected to become the paying clients of the services. The G4AW partnerships need to understand the priorities of these potential clients and how the services can address these. These priorities include, amongst others, market intelligence, marketing/ advertising of products, increase customer loyalty, certification, CSR, more efficient claim verification. As the role of these aggregators is so important to create a sustainable business model, their needs have received a lot of attention, and many of the G4AW partnerships have created specific tools (e.g., Business Intelligence) to address them. The partnerships have often discussed internally what business could be relevant, but in some cases the partnerships have also contracted third-party consultants to study whether there are other businesses that could potentially be interested. For example, SpiceUp has worked with De Kleine Consultant to help identify the business case and potentially interested partners.

Experience with willingness to pay in GEOPOTATO

The partnership started out with the idea that farmers would subscribe to the GEOPOTATO service for a 2 Euro fee per season, which would be less than 1% of their total farmer production costs. Moreover, this fee was considered acceptable given the potential financial benefits for farmers, which was estimated to range between 100 and 250 Euro per hectare. In addition the willingness to pay was reported in the season endlines showed some indication this strategy could work. In reality, however, digital agricultural services are very new in Bangladesh, and especially services that are provided via SMS and extension workers.

The partnership changed their original idea and invested time into meeting with potential business partners such as service providers, potato processing industry, and agro-input suppliers. Service providers were eventually no option as they struggled with similar problems as the GEOPOTATO partnership. The processing industry was a too small market for a viable business case. This left the agro-input providers as the best option. Collaboration was started with agro-input suppliers ranging from providing inputs for demo-plots, sharing GEOPOTATO alerts and organizing own demo-plots to test the GEOPOTATO service.

The planned targeted businesses and the proposed service offering is often confidential, so practical examples cannot easily be provided. One example of a pain-gain canvas has been created by Sat4Rice. The partnership has brainstormed how the services can contribute both to smallholders (B2C) and business (B2B) (see the Figures 7 and 8 below).

Figure 7 Benefits for smallholders ©G4AW Sat4Rice / Nelen & Schuurmans

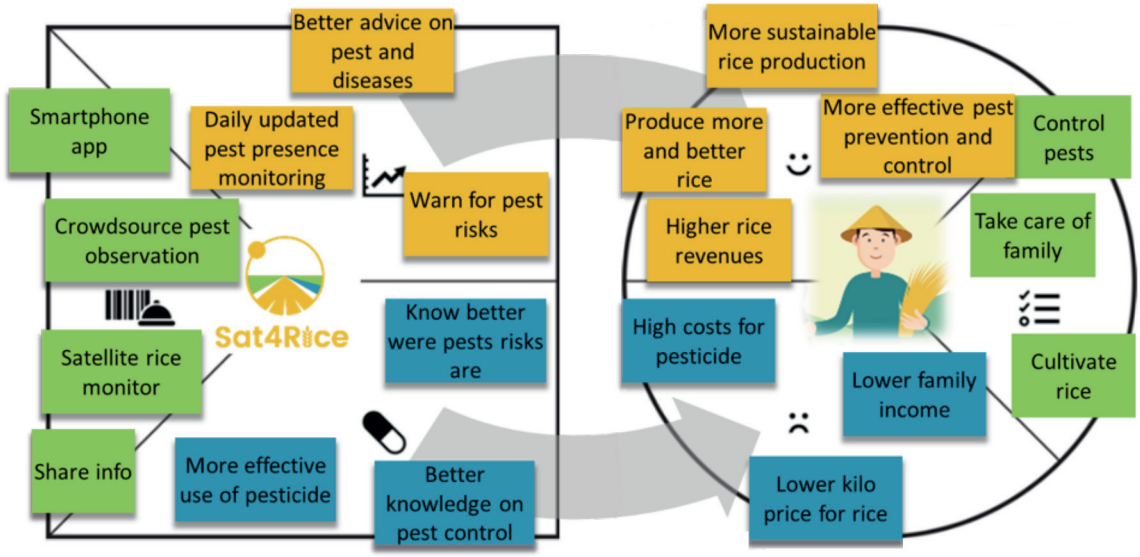
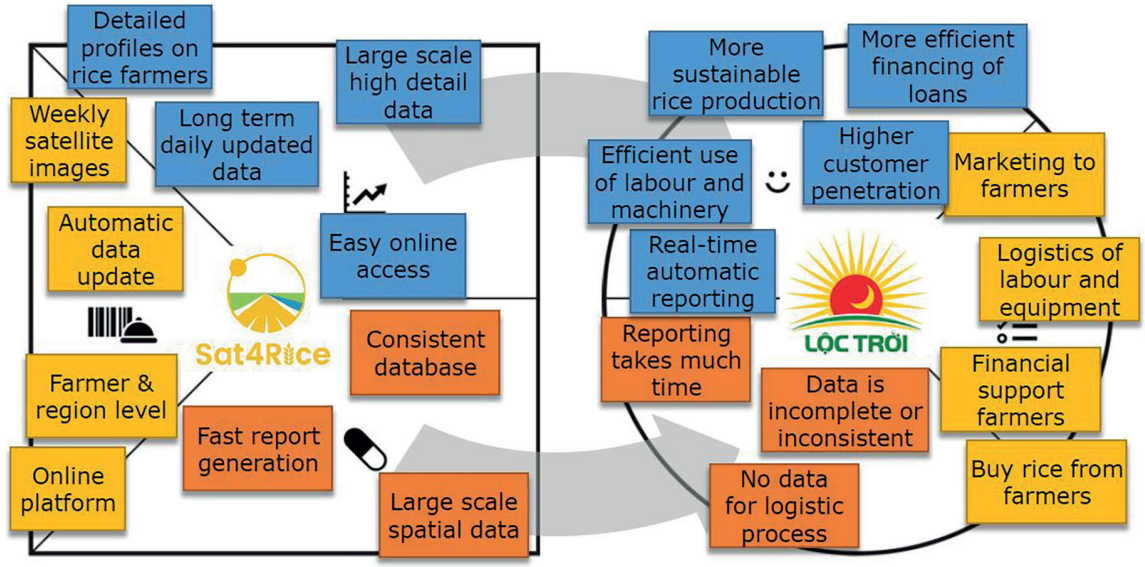


Figure 8 Benefits for businesses ©G4AW Sat4Rice / Nelen & Schuurmans



2.2. Created services

Within the G4AW portfolio, projects aim to offer a range of services. Weather information combined with crop monitoring, Good Agricultural Practices (GAP), crop disease information, market price information, and crop-based index insurance were the most commonly developed services in the G4AW projects. Two projects developed services for (agro-)pastoralists. The first lessons learned document provides more background on these developed services.

2.3. Service optimization

Service optimisation is the process in which the partnerships aim to meet most of the needs of the different users, while at the same time ensuring the costs of running the service do not outweigh the income generated through sales of the services. This is a challenging process, especially because the needs of the users tend to be dynamic. Reducing costs will generally result in a certain imbalance in the partnership. This is because cost-saving approaches often imply removing or changing certain service or platform providers in the initial partnership. At the same time, very little revenue is generated through sales in the early stages of service provision.

Over 80% of the G4AW partnerships indicated they have implemented cost-saving strategies to optimise the economic viability of their services. Strategies mentioned are:

1. collaborating with other parties to share costs of e.g., marketing and farmer training
2. optimising the number of personnel in the core team
3. the use of open data instead of paying for data,
4. replacing existing service providers by more affordable ones, and
5. scaling the service to more farmers and other users to have economies of scale.

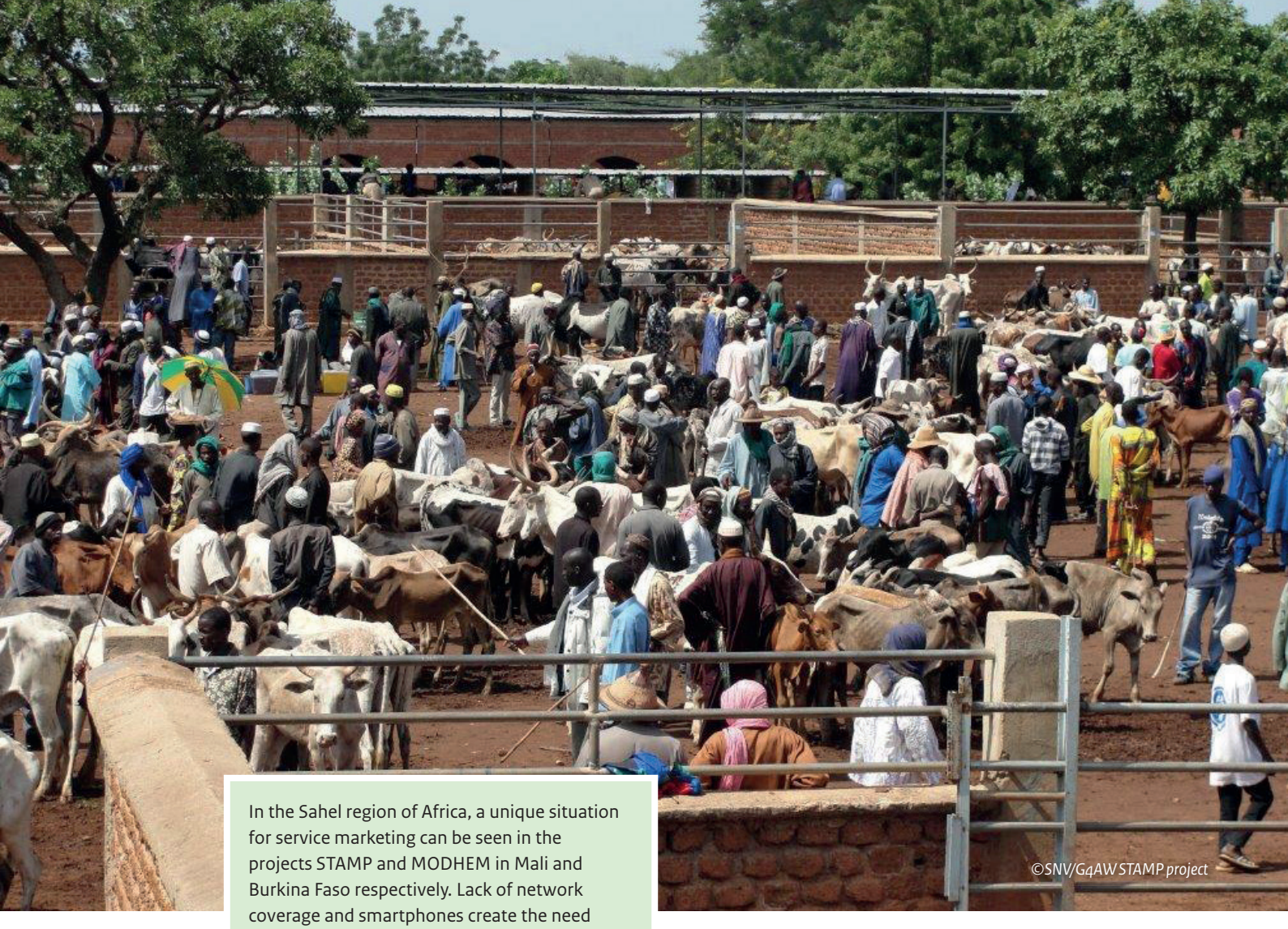
With these cost-saving strategies already implemented, almost half of the partnerships believe that the operational costs of running their service have been sufficiently optimised for profit generation. One-third is not sure whether the cost-optimisations have been, or will be, sufficient. Interestingly, of those partnerships that implemented cost-saving strategies, five partnerships are not sure what the effects will be for their target group(s) and whether this could compromise the quality of the service delivery, whereas two projects think it does compromise the service. The other ten partnerships think it does not compromise the service offering.

While satellite data would ideally remain an integral and highly valued part of the service, there have been projects in which the users valued other (non-satellite based) services higher, such as market intelligence. In some projects, providers of satellite data have been replaced by other data providers once the project ended, while other projects have removed the satellite-based services entirely after the project ended. For example, IDSS in Bangladesh and GREENcoffee continue service provisioning without the satellite-based data. This is generally because there is not (yet) sufficient added value to continue with these services. The overall attitude towards satellite-based services is still positive, but there is not always a good fit with the current business model.

In some projects, satellite data is clearly the main driver of the service. This is the case for crop-index insurance models, weather services, and navigation services for pastoralists. In many other projects, satellite data has a more supportive role. This is the case in most projects providing agricultural advice where satellite data plays a role alongside Good Agricultural Practices (GAP), market intelligence, and more.

When G4AW partners were asked for their biggest learnings regarding service optimisation, respondents reported (among others): 1) the importance of user-centred design of services together with the target group (e.g., farmers and extension workers), 2) the need for service bundling to create a more attractive proposition, and 3) the value of finding committed business partners that are willing to co-invest.

> *"Our two biggest learnings about how to optimise the value of our service proposition for our primary target group were to: (1) design a product that addresses a real need and that is simple and easy to use, and (2) by building a reputable service".*
>
> **Myvas4Agri, Myanmar**



©SNV/G4AW STAMP project

In the Sahel region of Africa, a unique situation for service marketing can be seen in the projects STAMP and MODHEM in Mali and Burkina Faso respectively. Lack of network coverage and smartphones create the need to campaign in the field. In many areas these local visits are hampered by conflict outbreaks. Local partners play a very important role as they already have the trust of the local communities. It is still very difficult to reach women in many of these high-conflict zones.

2.3.1. Service marketing

The need for marketing (sensitisation) of the services depends on the selected business model. In B2B models, the businesses who licence the services from the partnership will do the marketing towards the consumers. Marketing of services towards the businesses is more complicated and requires partnerships to find the right businesses and contacts within these businesses. This process of finding business partners is discussed in the business partners section.

Different approaches have been used in partnerships that already include a partner (aggregator) that can directly target the farmers. Furthermore, there are differences in the approaches between the Africa and Asia that are related to the types of services and platforms available. In Asia, partnerships have often hired specialised companies that focus on awareness raising. Social media is a key component in the used strategies. Most G4AW projects in Asia have a dedicated Facebook page. Active marketing is only relevant the moment a minimum viable product (MVP) is ready. This is often only in the last phase (year) of the projects. The benefit is that a lot of feedback (needs) is provided by farmers during awareness raising campaigns, but the downside is that there is limited time left to create a large user base.

In some projects in the last call of G4AW (SAM, Myvas4Agri, GAP4A), this MVP was already ready at the start of the project. This can be positive, as marketing can start at an earlier stage. Howeve, the risk is that users' needs are not sufficiently taking into account if there is insufficient focus on user engagement. Marketing campaigns are generally initiated directly after apps become available in online stores, and can result in rapid increases in users in a relatively short period. An advantage of social media marketing is that you have a large reach and a relatively balanced[7] target group that includes youth and women.

7 *Journeys of Connectivity: How People in Sub-Saharan Africa Come Online | Facebook IQ | Facebook for Business*

2.4. Service bundling

Bundling of services is an approach to optimise the services and make it attractive to more target groups (or to the same target group). Bundling, however, can be done in many different ways: bundling within the same service type, bundling with other service types, and bundling with services outside the agricultural value chain.

2.4.1. Bundling within the same service type

The most basic approach that many partnerships have taken is to use the same datasets to provide different types of advice to farmers. In this way, datasets such as weather information and a vegetation index are used to create a large 'bundle' of crop monitoring advice and insights. The overall service type does not change when taking this approach. For example, a basic vegetation index (e.g., NDVI) can be used to provide fertilizer advice to farmers, but can also be used to predict time and quantity of yields. Agribusiness can use this to plan their logistics operations. In general, no new partners are needed when taking this approach. The cost-optimisation strategy is linked to scaling the services to more farmers and other users (by creating a clearer link to the agronomic challenges different smallholder segments are facing).

2.4.2. Bundling with other service types

A second approach to service bundling is by bundling services that cover different service types. This can be a combination of agronomic advice with, for example, market intelligence, crop insurance, or access to finance. This will increase the actionability of the advice, as most of the challenges faced by smallholders are included. In many cases, smallholders cannot invest due to lack of access to finance, or will not invest due to lack of insurance if the new technology does not provide desired results.

Another clear need for an additional service has been the creation of features, such as risk profiling to attract interest of financial institutions. This type of service is highly specialised and cannot be based on open data only, as it requires farm-specific information. In the technical assistance trajectory by BopInc, five out of six involved partnerships indicated that adding this kind of service was their key priority based on the assumption that this would help attract interest from MFIs.

2.4.3. Bundling with services outside of the agricultural value chain

A final approach to service bundling is by adding services that cover aspects outside of the agricultural value chain. For smallholders, the agricultural sector is at the centre of their day-to-day activities and their primary source of income. They are, however, also interested in and influenced by activities in different sectors. This includes health information, financial planning, and more.

For most of this information, there are multiple and much more advanced alternatives, but some G4AW partnerships have successfully integrated services related to aspects outside of the agricultural value chain. A good example is the GAP4A project in Burundi. In this partnership, the so-called G50 approach is implemented. Households are organised in natural groups of approximately 50 neighbouring households (hence 'G50') based on existing social structures. They have to elect three local leaders, representing male and female, old and young people within the G50. Each group has its own tablet which provides them the opportunity to start e-banking at a local MFI using their own account.

2.5. Financial services

In 2020, NSO has decided to have the financial service component of the G4AW and G4IFF[8] programme evaluated. The evaluation was executed by NpM and included three G4AW projects, namely CommonSense, MUIIS, and MyVas4Agri that have financial services as part of their service portfolio as well as the G4IFF projects TARA, Apollo Agriculture, and Agri-Wallet. The evaluation resulted in a report by NpM: "Geodata for Agtech and Fintech: What have we learned?" published in March 2021.

This following section will provide a short summary of the evaluated G4AW projects and the main insights gained. For more details, please see the NpM Report.

8 ***Geodata for Inclusive Finance and Food (G4IFF):*** *In order to promote innovative solutions that make use of geodata for inclusive finance, the Platform for Inclusive Finance (NpM) launched the G4IFF Innovator's Challenge. Participating tech and FinTech companies were challenged to develop geodata-based applications for Financial Institutions (FIs). NpM worked together with all G4IFF partners, with Rabobank Foundation, Bill & Melinda Gates Foundation and FMO each providing EUR 125,000 for the winners. The three winning innovations are: Agri-Wallet, Apollo Agriculture, and TARA. The projects were implemented and eventually closed in 2019.*

©Auxfin/GAP4A project

2.5.1. Type of financial services

When it comes to providing financial services, two main approaches to creation of products can be distinguished. The first is to have a focus on providing financial services from the start: in this approach all use of (geo)data is aimed at creating relevant services for financial institutions (e.g., credit risk scores). The G4IFF projects are examples of services, based on geodata, that have financial inclusion as primary services from the start. Some G4AW projects also fall under this category such as Sat4Business in Ghana. Sat4Business aims at developing financial services for cocoa and palm-oil farmers.

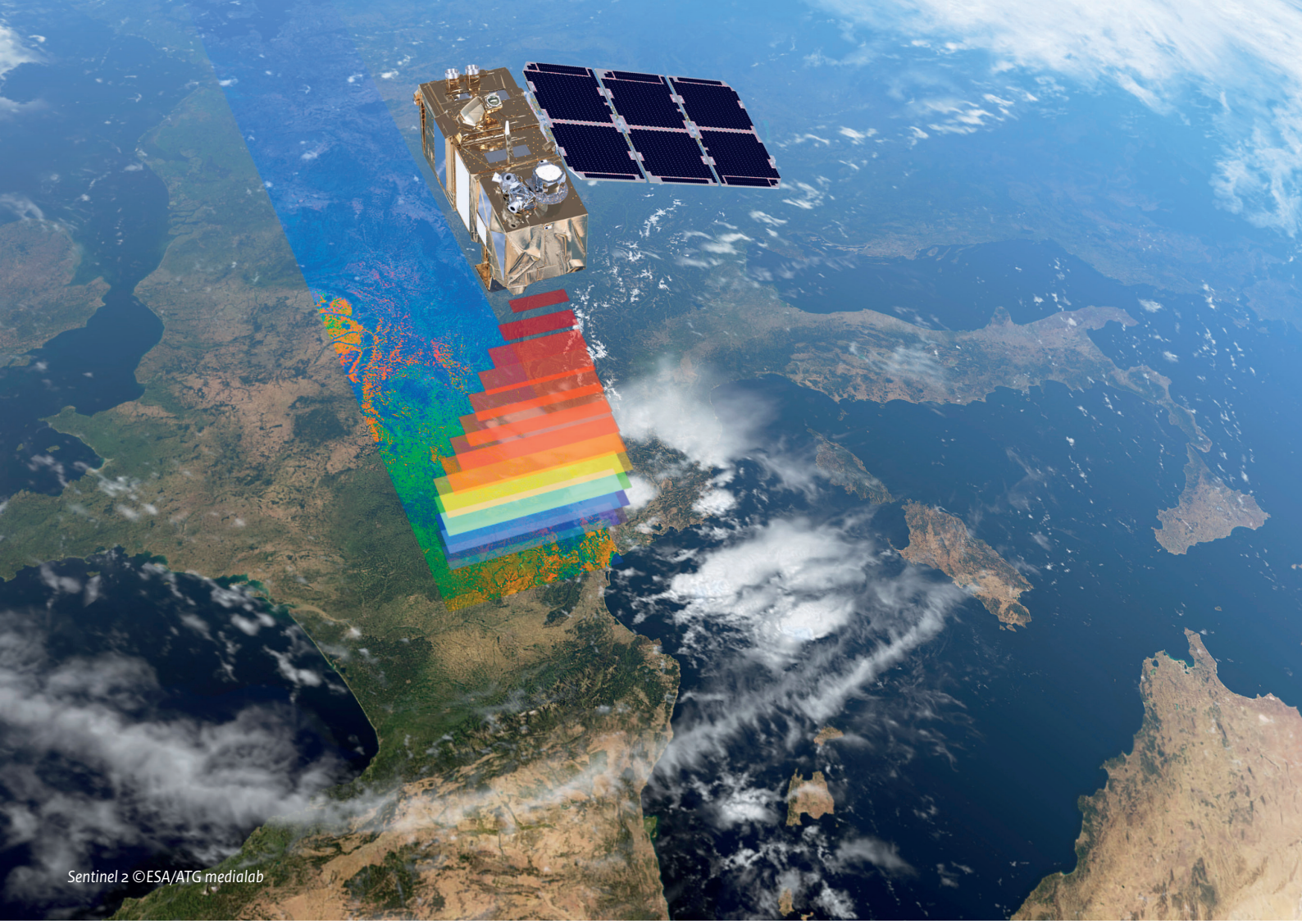
The second approach is to add financial services to existing G4AW projects. This is often done to create interest from financial institutions, and uses existing data such as farmer registration to create services that could be relevant to financial institutions. This approach has already been applied in several G4AW projects (in some cases after G4AW funding ended), and several ongoing partnerships are also considering adding financial services to their portfolio.

There are several types of financial services for smallholder farmers such as loans, insurance, or pensions. Micro-loans or input loans that are used by farmers to buy seeds or fertilizers are the most common example.

Secondly, index-based insurances to protect farmers from losses incurred is also gaining rapidly in popularity.

Index-based insurance is insurance that covers the conditions that lead to specific losses, rather than the actual loss itself. The pay-out to farmers is based on the predefined loss related to certain conditions. Indices that are used in G4AW projects include evapotranspiration (SUM Africa, MUIIS), and NDVI (GIACIS). Other parameters that can be used for index-based insurance include rainfall, drought (soil moisture), and extreme weather events. The impact of these conditions on crop losses is derived from long time series of remote sensing data. If the indicator drops below or exceeds a certain threshold, pay-out is triggered.

The main benefit over traditional (claims-based) insurance is the low costs required for monitoring, taxation and administration. This reduces the need for local staff to make time-consuming field visits. Fraud can be reduced, as the index is objective and cannot be influenced by the farmers. Four G4AW projects (of which three in the first call) have specifically focused on crop insurance: one in Indonesia (G4INDO) and three in Africa (GIACIS, MUIIS and SUM Africa).



Sentinel 2 ©ESA/ATG medialab

2.5.2. Use of geodata for financial services

Only limited types of loans are available within the smallholder banking sector. This is due to the perceived high risk of lending to smallholder farmers. Geodata can help financial institutions de-risk lending to the smallholder agro sector by providing relevant information. The projects that have been evaluated had very different use of geodata for the financial services with differing successes.

MUIIS: Geodata was the major source of information delivered to farmers. The main components were satellite weather data, including windspeed, rainfall amounts, moisture levels and temperature; satellite agronomic data, which looked at field conditions and pests; and satellite insurance data, which drew from the weather data and field conditions to score for pay-out or not.

Satellite data is invaluable for index insurance as it allows an insurance company to have accurate satellite data showing the status of a farm and determine crop loss and when it happened. This reduces the interaction of farmers and field agents in this process as well as reduce the amount of inaccurate data sent by the field team. This model would also be more cost effective if the insurance company has a large number of farmers in its portfolio.

CommonSense: Weather Impact partnered with the National Metrological Agency to provide weather data to both the Agromet service and the Weather Forecast service. They provided tailored weather solutions for the agricultural sector, including rainfall forecasts, temperature information and wind data. All this helped farmers determine when to plant and sow their crops, and other farming activities.

The A-CAT system also had access to weather data, which they incorporated into their credit/loan approval process. As a result, the FIs that used A-CAT were able to more accurately determine which farmers were eligible for loan products, and improve their loan repayment rates due to increased yields from farmers receiving loans. Within the partnership overall, the farmers saw improved production due to the actionable advice they received from advisory services based on climactic conditions.

2.5.3. Client base

The current client base for many of the G4AW services is still relatively small. It is unlikely that the current numbers are sufficient to attract the interest of MFIs as paying clients for the unlocking of access to a new client base. In successful examples, numbers of active users were upwards of around 10,000 active users (as an absolute minimum). The big question is whether partnerships would first need to grow to that level of users to make any investment in credit scoring mechanisms/ integrations worthwhile, or whether they believe such functionalities are actually needed to grow to such numbers. It is anticipated that with client bases with numbers generally seen in G4AW, most MFIs would not yet be willing to (co-)invest into building such functionalities in the current services.

It is important to understand the needs (pain) of MFIs, which can differ a lot. Some MFIs are fully focused on generating maximum revenues and have no interest in these innovations, as they already have a well-functioning system and are not interested in reducing their interest rate to attract more customers. Other MFIs are closer to social enterprises and could be interested in joining in these innovations even if the customer base is not yet high. This would allow them to grow into this new market, understand the potential, and also help smallholders improve their livelihoods.

2.5.4. The business case of financial services

Index-based insurance provides a clear business proposition. This proposition has attracted a range of other parties, which enabled the service providers to develop similar products outside of the context of G4AW. This scaling opportunity contributes to the expected outcome of G4AW: support the development of an emerging market. It also contributes to achieving a greater impact with G4AW investments. This shows in the relative success of MUIIS in developing their services.

It is important to have a commercial partner in the partnership to help sustainability of the project. In the CommonSense project, the only source of revenue would have been through payment of their platform either by the end-user or the traders and unions. It may be safe to say that this was a motivation as well for the team to look at a model where they would get a return on investment as the platform is part of their day-day core business.

The use of geodata in credit scoring is quite costly initially, however, with the right combination, it could prove to be beneficial and have a return on invest. For instance, when the target market does not need constant GPS location recorded each cycle by the field agents due to crop rotation, the costs become manageable and even scaling such a model becomes affordable.

Insurance companies would be willing to use geodata in their scoring models as they are able to have accurate data throughout the season with less chances of the field agents giving inaccurate data. This will allow them to scale their reach, improve repayment rates and improve customer satisfaction as the right farmers will be paid in case of crop loss.

2.5.5. General lessons learned financial services

When loans are being provided to farmers, proper vetting must be done to determine risk factors faced by each farmer, and their probability of making payments. The risks we need to look at are: individual farmer risk, input, access to market, GAP, etc. All this information helps the loan facilitator determine the likelihood of a farmer repaying their loans.

Focusing on smaller regions as opposed to a large geographical region is quite essential and allows for more effective management of a loan portfolio. This is because there are limited resources for loan collection and when farmers are concentrated over a small region it offers a chance for better management by the field and recollection agents. More people gained access to finance through the platform. In particular those who did not have a bank history that could be used to rate them via a financial service provider.

Some partnerships assume that they can monetise on their farmer registrations by creating farmer profiles and related credit risk scores. The main challenge is that this data simply does not have sufficient quality to be used as input in accurate risk scores. Risk scores require validation and authentication. Farmer input used for agronomic advice has to meet significantly lower quality standards (e.g., crop, location, date) than data used to decide on credit risk (historic crop performance, age, family, farming and other assets, existing loans, etc.).

For example, The MUIIS project initially started with the goal of providing advisory services to farmers and registered about 350,000 on their platform. Unfortunately, most of the farmers were not willing to pay for advisory services, which endangered the continuity of the project. MUIIS approached Rabobank Foundation for on-lending capital, which they could use to provide farmers with loans as part of a bundled service, because the project still had a large database of farmers they could use. The first findings showed that the initial rate of repayment was low, as some of the data collected during the initial stage had not been authenticated (such as farmer locations). This problem will now have to be solved in a next phase with local business owner and service provider Ensibukoo. This could mean that existing registrations might – at least partly – be partly worthless as input in creating risk scores. This could be a significant setback to many projects, as the actual registration process seems to be one of the largest challenges for using the apps.

In conclusion, geodata is an essential aspect to credit scoring to help companies have more accurate data. However, to ensure that it is scalable, more work needs to be done to ensure there is high quality validation data which allows the financial service providers rely more on the data provided.

2.6 Willingness to pay

While smallholders are central to most of the objectives of G4AW, it was assumed from the outset of the G4AW programme that smallholders would have only a limited capacity and willingness to pay for the services, e.g., 5-10 euros per year (<1% of annual income). Many projects carried out assessments of the willingness to pay, which varied greatly between countries, target groups and type of services. Even if smallholders were willing to pay, they were generally only prepared to pay a limited amount that by itself was not sufficient to recover costs during the project phase. It remains to be seen whether projects can create a sufficiently large user base and willingness to pay to recover costs with a B2C model in the post project phase.

An example of a service for which it is often very difficult to find paying smallholders is the provision of weather information. This is because potential clients often see it as responsibility of the government and can easily share the information within their community. Another example is the willingness to pay for plot-level advice. The problem is often that there is a certain inaccuracy in the models, especially in the early stages when there is not yet sufficient information available from farmers to calibrate and verify the advice provided. To ensure advice can be verified, free trials are generally provided in the early stages of the model. A downside of this, however, is that farmers become accustomed to the free services and are no longer willing to pay for the services once the trial ends.

For several projects, the Direct Revenue business model (B2C) remains a significant part of the overall business case. Projects that continue with a B2C offering have generally conducted studies on the willingness to pay to understand the amount they could charge for the services and the expected percentage of total users that could be expected to become a 'premium' member of the services. This willingness to pay has also received particular attention in the external evaluation of some projects (see box of an example for SMARTseeds). The conclusion in this case was that farmers are not willing to pay for the information service since they do not obtain direct benefit from the app. This, however, does not automatically mean that the Direct Revenue model is not viable.

It was concluded that main problem in SMARTseeds was that the 'desired behaviour' (pay for the service) is placed ahead of the 'reward' (increased income)

smallholders receive. This may contribute to their unwillingness to pay. A direct business model with a small fee from smallholders can still be applied in many projects, but the partnerships need to provide more incentives than simply practical content in the app. It is also recommended that partnerships focus on creating services that create direct rewards, such as an online marketplace or discounts on certain services. Having direct cost-saving (discount on products that are used anyway) or increase in revenue (sell products at better price through online marketplace) will likely increase the incentive of farmers to pay a small fee.

Currently, the direct revenue model in which farmers pay for the information services is not proven in project X. Until today, the project does not charge farmers for using project X's service. The policy of giving farmers free access to The service is based on the realisation that farmers are not willing to pay for the services. Interviews with active users confirmed farmers' unwillingness to subscribe to project X's service for a fee of around EUR 7 as put in this project's business plan. This finding invalidates that of the baseline survey that notes farmers were willing to pay EUR 12/year for information services. The gap between farmers' statements in a survey and the commitment to pay in a real situation is not exclusive to this particular project. Many mobile-phone based information service projects indicate the same phenomenon although some services are able to get user subscriptions for a small fee.

In several G4AW projects, the cost of the services has been included in other services (tangible products such as fertilizers, or intangible products such as insurance). In this way, farmers are not fully aware that they are paying customers and see the service as free, increasing satisfaction. Some of the reasons why farmers might not pay for different services, and possible approaches to overcome these, are provided next. More information on the created services is provided in part one of the lessons learned. Five general groups of services are included: good agricultural practices (GAP), weather forecasts, crop/plot specific advice, market information, crop-insurance.

2.6.1 Good agricultural practices

Providing information on good agricultural practices is generally seen as a task for the government. Government agricultural extension workers are (and have often been for decades) providing this information to smallholders. Farmers require to see the success of new things before they believe it, which means it has to be linked to (relatively costly and difficult to scale) field-visits and use of demo plots. The basic nature of the service also makes it easily shared between smallholders in a certain community, which makes creation of a sustainable business model more challenging.

In the G4AW partnerships that provide GAP, public research organisations are generally compiling the information. GAP advice is simply a set of practices that are 'triggered' on farmers' phones based on certain changes in vegetation indices, weather conditions, or date (relative to sowing). In and of itself there are little operational costs to providing GAP. GAP is thus mainly added to other services to increase customer loyalty and CSR of the businesses. Because companies are eager to add GAP due to its good benefit to cost ratio (CSR, higher production, customer loyalty, and more), farmers generally do not need to pay for this service.

2.6.2. Crop/plot-specific advice

Advice at the level of individual plots includes fertilizer advice, pest and disease warnings, crop yield prediction, irrigation advice, variety selection, among others. These services provide very valuable analytics related to *prediction, intervention, and prevention*, which can provide actionable insights to both the smallholders as possible business partners. At the same time, advice at plot level requires a lot of inputs and processing, which is still relatively costly.

Many of these services are largely based on existing and widely used (hence validated/calibrated) agronomic and soil-nutrient models. The limitation to many of these services remains that farmers need to provide part of the required input themselves. This includes sowing date, crop type, and often also soil type. If these are not provided, the model might be less accurate.

This remains an important trade-off in many digital services that provide crop-level advice; if you ask farmers for input too frequently, they might become frustrated and stop providing input. However, if you do not ask enough, advice might become incorrect. Ideally, missing inputs would be predicted based on feedback from other farmers and/or data from other years. Creating such a machine-learning solution to deal with missing inputs will generally require several years of data for a significant number of farmers to sufficiently calibrate and validate the results in (often free) trials.

The main benefit of providing crop/plot level advice is that it is often linked to the provisioning of certain products such as pesticides, fertilizers, seeds, and more. While farmers might not be willing to pay for the service as stand-alone product, the costs of the services can be included in the products that are sold (inclusive model).

It is also worth mentioning that various respondents still struggle to deliver on their promise of providing very precise advisory services when the (earth observation) data they use does not provide this level of accuracy. This is related to the problem with some crops (e.g., coffee, cocoa) to 'translate' data into insights and advice. While more general information (e.g., weather forecasts) can be provided, plot-level advice is difficult to provide based on EO data alone.

The difference between GAP and crop/plot specific advice is that GAP is the replacement of what used to be the farmer extension programmes and therefore a cost-effective way to sustainably increase crop production. Within GAP the only satellite data derived service is the weather information, which is crucial for any farming practice. Crop/plot specific advice, however, is highly specific information per plot. This means that providing crop-plot specific advice is very costly given the complex processing required, more information requirements, and the complexity of providing relevant insights into diverse ecosystems. The advantages are better insights of farmers (farmer profiles, yield estimations), and more marketing for products (B2B).

2.6.3. Weather forecasts

Weather information is highly valued by smallholders and has become the 'key selling point' in 30% of the G4AW products according to the business lead. The main challenges are to show the benefits over existing (free) weather forecasts and ensure that sharing of messages in a community does not significantly reduce the paying customer base. An SMS survey in the CROPMON project in Kenya found that the weather advice was, on average, shared with seven other people in the community. While many smallholders consider it the responsibility of the government to provide weather information, the service provided by the government is often too coarse for agricultural operations. The first approach to improve willingness to pay is thus simply to improve accuracy (spatial

detail, reliability) of the provided forecast. The second approach is to make the service unique for each farmer by providing a stronger link to actionable and crop-specific advice. This means linking advice to GAP or crop/plot-specific advice. While farmers can share the weather forecast, they cannot share these actions, as this will vary based on crop, soil, sowing date, etc. CROPMON has created two different service levels, to first attract users and after this provide more accurate services for which a payment is expected.

Weather information is an integral part of many of the created services. In different G4AW partnerships, one of the partners pays for the weather service and uses this to improve the services they sell to smallholders.

2.6.4. Financial services

Bundling of services is a great way to incentivise farmers to pay for products/services which they view as non-essential. Farmers generally do not see the need to pay for weather advice and extension services, as treated in agromet and the weather forecast service. On the Terra platform, however, the farmers were willing to pay, as on top of the loans provided through vouchers, they would then be able to receive a union management platform. We also learned that smallholders are reluctant to pay for digital extension, regardless of the usefulness of the information. Once it is bundled with another product, the project owner can monetise this solution without the farmer having to pay for it directly.

CROPMON basic and premium service-levels:

Basic Service: message service that provides weather forecasts only called 'CROPMON Light', was introduced as an easy introduction to CROPMON Full Service and to speed up the scaling process. The service was offered for free. At the end of the project, a total of approximately 160,000 users were registered.

Full Service: crop monitoring, advice and weather forecast messages. The farmers who subscribed received precise parcel perimeter registration by GPS. This service was also offered for free during project implementation. At the end of the project, a total of approximately 35,000 users were registered.

Around the end of the project, 60% of users were willing to pay for the service. Main reasons for farmers that were unwilling to pay were financial constraints (50%), lack of satisfaction (13%) and the opinion that this should remain a free service that should be supported by the government (8%). Further commercialisation of CROPMON is also hindered, because many donor initiatives in the region offer relatively similar D4Ag services for free.

After project closure, CROPMON Basic Service is continued free of charge to build further trust with subscribed farmers. Farmers can still provide feedback on provided services, which can be used to improve the services and service provision. The business plan is further developed and when required a payment system can be integrated in the service provision.

3. Business models

Business models in G4AW include a focus on optimising costs and maximising sales. Costs include all the activities associated with development and production of the service and the recurring costs. In the case of G4AW this is research, design, creation, processing, testing, and hosting of the services, as well as delivery of operational satellite-based data. Benefits includes all activities associated with sales and delivery of the services (benefits) to the different target groups. In a sustainable business model, the benefits should be equal or higher than the costs from the moment that break-even has been reached. There are many approaches to create a positive balance, either by reducing costs or by increasing the benefits. Approaches to reduce costs have already been discussed in the section on cost optimisation. This section will mainly focus on the approaches to increase the benefits.

Subsidy programs such as G4AW help the partnerships to achieve a sustainable business. This support helps reduce the costs for the business owner (in this case the partnership) in the development and demonstration phase, which helps to reduce the risk. This in turn can help reduce the time required to reach break-even, which is an important consideration of investors for investing in such tools. Still, subsidies will not help if there is no clear service and user base. Reducing costs is often the easier part of creating a sustainable business. More challenging is to create significant revenues.

G4AW partnerships have struggled to find the best business models, which has often resulted in some form of hybrid model including aspects from different business models, in which business partners have become involved. The reasons (incentives) for the business to be involved include amongst others:

- customer retention (loyalty)
- corporate sustainable responsibility
- better product offering
- more efficient business operations
- business intelligence

3.1. Possible business models

Many different business models can be identified[9], but at the most basic level, only two categories of business models can be identified in G4AW: B2C and B2B. The first B relates to the business owner in the G4AW partnership. In B2C, the C stands for the consumer. In G4AW, these consumers are smallholder food producers, which can be farmers or (agro)pastoralists. In B2B, the second B can either be an agribusiness, financial institute, telecom operator, or other business (aggregator) that interacts with smallholder food producers and is willing to pay for the service(s).

3.1.1. B2C models

The ways in which smallholders can (directly) pay for services are relatively limited. It is estimated that 1.7 billion adults do not have access to a bank account, but around two-thirds of these (1.1 billion) do have access to a mobile phone[10]. A solution is to use mobile technology to increase financial access[11].

The two most common business models for B2C services in G4AW are **pay-per-use** and (premium) **subscriptions**. Food producers pay for a single advice (e.g., calling to call centres in MODHEM/STAMP) or pay a monthly fee to get a weekly update on weather information and other relevant advice. In some business models, there is a hybrid business model (**freemium** model), in which farmers get a certain basic set of (subsidised) functions, and have to pay an extra fee (pay per use) for additional features. The SMARTseeds project in Indonesia is implementing this freemium model for the 'chat with experts' function, that allows smallholders to ask a few questions for free, after which they will have to pay for additional advice. This lowers the level of entry for these services.

While surveys in some projects have found a certain willingness to pay (WTP), even charging an amount significantly lower than this surveyed WTP (in the case of SMARTseeds and SpiceUp in Indonesia between 7

9 *50 Types of Business Models (2021) - The Best Examples of Companies Using It | Business Strategy Hub (bstrategyhub.com)*

10 *Digital inclusion of all (itu.int)*

11 *IFAD (2016). Lessons Learned, digital financial services for smallholder households.*

and 10 euros per year) resulted in limited success so far. This, however, is not only related to the fee that is charged, but also to the limited understanding of the rewards for the smallholders.

It is observed in many G4AW partnerships that revenues from B2C are not covering operational service delivery yet. Some business leads completely abandon the (direct) B2C model, while other reduce the importance of this model (generally well below half of total expected revenues). It has become clear that complementary finance (revenues or investments) is needed. Investment does not always require a direct flow of cash from the business partner to the partnership, but can also be through taking up some of the operational costs.

Complementary funding for B2C service provision to food producers may come from B2B service provision. While the general service is still oriented to the smallholders (similar to the existing B2C offering), the business partner is interested to pay for information that helps them more efficiently sell or buy products from these smallholders (or to increase their CRS focus). For example, Orange is paying for operational costs of the call centres that are required in the SNV-led projects for (agro-) pastoralists in West Africa.

3.1.2. B2B models

B2B models are much more diverse than B2C models. Firstly, this is because the value of the service can be much more diverse to different types of businesses. Businesses value many aspects that cannot be (directly) translated to monetary terms. This includes increased customer loyalty (retention), risk mitigation, CSR (including certification), and more. Secondly, businesses also have more options to pay for the services. This can be for one-time advertising, a basic subscription (subsidising services for farmers), or a flexible premium based on sales of services. In most of the developed B2B models, the businesses that use and/or provide the services have some interest in CSR and making their activities more sustainable. This is in line with the objectives of G4AW related to a decrease in use of certain inputs. This can be the main or a spinoff benefit.

In most B2B models for agribusiness the primary focus is customer retention. The agribusiness buys the geodata-based service, but provides it for free as long as smallholders purchase their other products. For agribusiness, costs for paying for such geodata services come on top of the existing costs for their operations, and generally do not result in a direct saving of operational costs. This means that, while costs are not visible to farmers, part of the costs may be included in the product pricing.

For B2B models in which financial institutions are involved, the primary focus is risk reduction (and with this the ability to sell loans to more smallholders, as the risks become manageable). Using geodata helps to increase the quality of risks assessment, which helps to make better decisions. This means that use of geodata can result in a potential large saving if the customer base is sufficiently large. This means that the financial service providers are often willing to provide the created digital (G4AW) service to smallholders for free to ensure enough data is available for their analyses.

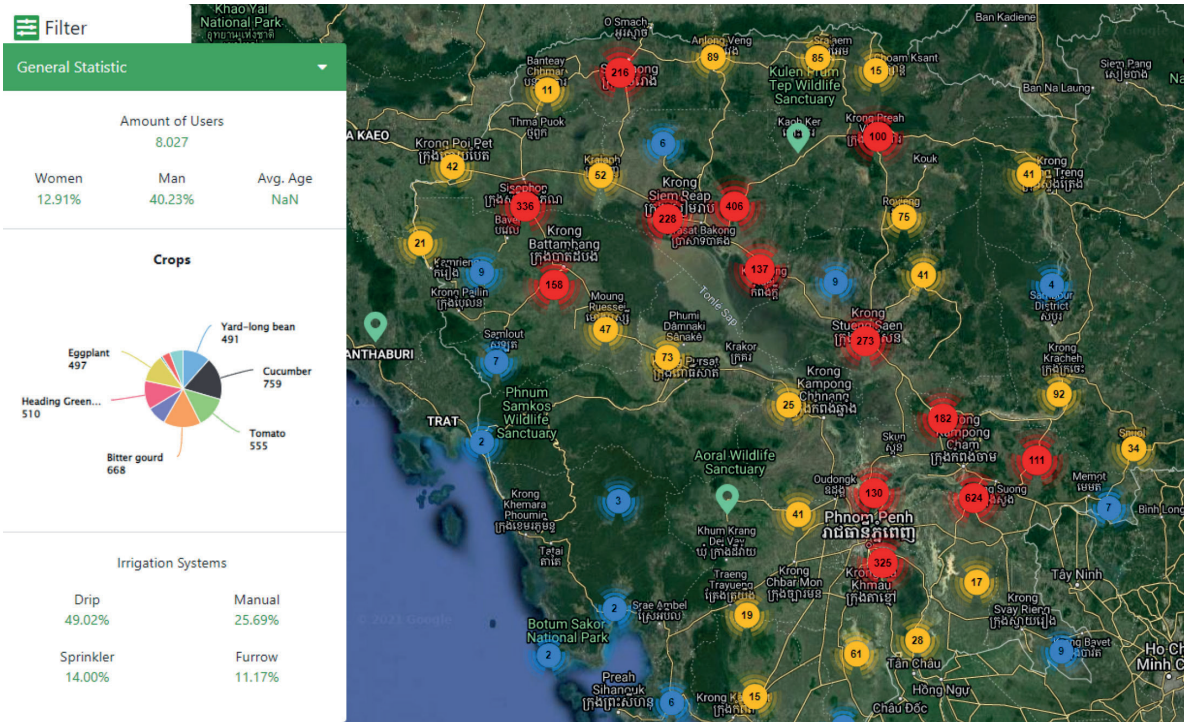
3.2. Business challenges

The most important business challenge is to create a stable flow of income. Even if the product is highly optimised from the cost perspective, income has to be generated. There are many reasons why **generating stable income** has been a major challenge for G4AW partnerships. Two underlying key reasons are discussed: difficulty to retain customers and unclear business commitment.

3.2.1. Customer retention

Retaining customers has been a key challenge for G4AW partnerships. While uptake generally has been high (as seen by downloads), retention of customers is still a challenge. Part of this is simply based on the difficulty to monitor the following parameters: many partnerships struggle to accurately separate total users, unique users, returning users, and other indicators that give insights as to the possible increase or decrease of the customer base. Without pay-per-use, it is sometimes unclear how and if farmers are using the services. In the case of mobile apps, there is a lot of competition for the limited storage space on feature phones.

Figure 9 Angkor Salad dashboard to monitor the current use of the created app



The AngkorSalad project in Cambodia has created a dashboard (Figure 9) in which the current (monthly) users can be visualised according to their location. This gives a good insight of the 'hotspots' of users, and can also be used to understand changes over time and in geographic distribution.

3.2.2. Accessibility and ease of use

Services need to be easily accessible. In some projects, the partnerships overestimated mobile network accessibility. Large investments are often needed to improve the mobile network infrastructure. Conflicts may delay new investments and even lead to the destruction of existing infrastructure. This results in farmers sometimes having to travel to internet hotspots to access services. If farmers have to make a large effort to use services, their interest will likely quickly decrease unless there is a clear added value of the service and or a perception that it is likely that network accessibility will be restored and/or expanded. Solutions include the creation of more offline features, so that services can be used without having access to a network.

Creation of offline features has become a priority in SpiceUp in Indonesia, as the remoteness of the pepper farmers resulted in a low access to internet, while the overall access to internet in the targeted regions was relatively high. This shows that access to internet is not simply something that can be assessed at administrative level, but also has to be assessed for specific smallholder segments.

The relatively high age of the average smallholders generally means that digital literacy is quite low. In several G4AW projects, specific training has been done on how to use the applications. There has been an important role for the youth in this training process. In the AngkorSalad project, youth has been trained (through their educational programs), which subsequently use this knowledge to train people with limited digital literacy. In many of the other G4AW projects, extensions officers have been trained in how to use the app. They can use this training to either provide direct advice to farmers (e.g., Farmer Friends in the Sat4Rice projects), or to train farmers on how to use the services.

Even if the final users have had some training in the use of the application, this training is not necessarily retained for an extended period. Some of the knowledge might disappear and new features will also mean the training has to be updated. To reduce problems related to lack of (digital) literacy, applications need to be created in

an intuitive (visual) way, and support (such as trainings) should be easily accessible and frequent. Icons should be easy to understand, recommendations for action should be clearly explained, and the initial registration process should not be too complex. An UI/UX design[12] trajectory can help to find the current bottlenecks.

3.2.3. Seasonal nature of agriculture

One key challenge in customer retention is related to the highly seasonal nature of agriculture. In case services only provide agronomic advice or seasonal flood updates, this is only relevant in the growing season(s). Specific services, such as irrigation advice are even more limited to a certain time window, as irrigation advice is only relevant in dry seasons when and where water is a key limiting factor. This seasonal nature of farming means that, in case of B2C models, income will only be generated in some key periods throughout the year. Another problem is the limited memory on smartphones. If an app is only relevant ten times per year, smallholders might prefer to use their limited space for apps related to social media or other information that is relevant for longer periods.

An example of a service that has seen the impact of this seasonal variation is the Garbal service provision (STAMP and MODHEM projects): pastoralists only use this in dry periods in which water and biomass are difficult to reach. In wet periods (such as the flooding in 2020), the service is not used for a longer period. It is hard to retain customers if they have not required a service for a certain period. In the case of services based on contacting call centres, this is not always a problem, as farmers only need to pay when they call a certain number (hence no need to install and pay for an app), and the number of Garbal-specific employees at call centres can be increased based on needs.

Smartphone apps, on the other hand, are frequently removed during these periods of limited need, and replaced by other applications, photos, and videos that are more interesting. In order to retain customers, the services could be made relevant outside of the growing season as well. Features, such as weather forecast and market information are always relevant. Both these services are being added in the Garbal services to deal with this seasonal variation, but also to create services that are more relevant to different target groups (including women).

Except for the addition of new services, another approach is to make the experience of app-use more rewarding. This can be done by providing a certain 'reward' every time the farmers finalise a task (which can also be outside of the growing season, such as crop selection or financial planning). Several G4AW are still considering the different options, but this is not something that has been practically implemented yet.

3.2.4. Limited monitoring and evaluation

Another challenge related to customer retention is the difficulty to accurately monitor and evaluate the use of the apps. Most G4AW partnerships are heavily focused on the overall reach (linked to downloads). As most of them have already abandoned B2C models and are aiming for B2B models, there is often less incentive to fully understand the dynamics of different types of users. This is because payments are no longer linked to B2C, but B2B, which is often related to the total registered user base and not usage frequency. The limitation of the focus on B2B models is that the challenge is to add more users (for example to create more farmer profiles) and not always to actively retain them.

For some B2B models, such as inclusive models and advertising models, customer retention is still very important. Overall, more focus could be placed on frequent monitoring and evaluation of the actual users. *Where and when do they use the app, and for how long do they check certain components of the app?* Also, this can help to understand the different smallholder (or other) segments that use the app.

3.2.5. Operational costs

Satellite data works very well for crops within farmer plots that do not have crop rotation such as coffee and

> *"A clear request formulated by financial service providers (government and others) related to geodata is for a check on an area actually sown or planted. Farmers can request soft credits, often in the form of tokens, for fertilizer, based on the size of their farm. The size of the farm is known through farm profiling. However, they do not always use the full extent of their farm for cultivation. Therefore, a check is needed to assess farmer compliance, and (VHR-based) satellite information is seen as a solution."*
>
> **HCP international**

12 *User Interface (UI) and User Experience (UX) design*

tea. Crop rotation is generally not a 100% replacement of a crop with another crop on a certain plot, but also includes a larger redistribution of crops on different plots. This means that each season farmers or field agents have to re-map the GPS coordinates of the crops grown on different plot (as each crop can also be expected to provide different income). This would prove to be highly inefficient from an operational perspective. Part of these field visits could be replaced by using (VHR) satellite data linked to historical records that can be used to automatically update plots and crops.

3.2.6. Customer satisfaction

A related issue is that there has been a limited focus on customer satisfaction in early stages of most G4AW projects. Many projects have focused on this at some point, but generally quite late in the projects (final year / external evaluation). The services that have a direct B2C model have more incentive to frequently update their customer satisfaction survey to monitor changes over time (and what the effect is of updates and improvement of the services).

While it makes sense that this customer satisfaction survey is done quite late in the project, as services are generally ready for launching towards the end of the project, this limits the actions the partnership can take. Especially when satisfaction is low for the core-components of the app (not simply accuracy of the advice, but difficulty to understand the app and register), this may require significant and costly updates.

When this is done late in the project, this will not only require additional costs for app development, but also a completely new awareness raising and marketing campaign to convince the smallholders the app now meets their demands. A good understanding of customer satisfaction (based on active user engagement) should be available before the app is widely launched. A diverse group of different users should be involved in testing of the app (trials).

3.2.7. Business commitment

Around 90 percent of G4AW partnerships have managed to establish new business partnerships with (large) organisations that were outside the original partnership. This shows that they are willing and capable to engage these organisations. It is, however, difficult to fully value the level of commitment of these new partners. Many businesses might be engaged as a temporary partner and not a (future) paying customer. Several of the G4AW business leads mentioned that large corporates such as input suppliers and telecom operators were often more interested to sponsor pilot activities (making the G4AW services available for free to smallholders) than to pay for a service for the longer term.

There are several reasons why involvement of business partners has ended after an initial trial period. This relates to a) the perceived low added value of services (not accurate, or simply not in line with expectations); b) the difficulty to embed the services in the existing workflow (difficult to integrate in existing IT infrastructure, or not sufficient skilled personnel in use of such services); c) the difficulty to place the services in the management structure of the business (costs and benefits are not in the same 'team'); d) the costs of the services vis-à-vis those of competitors; and e) lack of funds to invest in such tools.

The COVID-19 pandemic is a challenging period for many businesses, which means that especially the lack of funds has been a problem for G4AW partnerships that were aiming to add B2B partners in 2020 and 2021. In addition to this, establishing B2B partnership generally requires to build trust, which if often still strongly linked to having face-to-face meetings.

If the underlying motivation of these large players is not fully understood, partnerships may overestimate the level and duration of commitment. Getting banks engaged is nice, but are they really willing to leverage the new service to give loans to smallholders given the perceived risks? They may show interest but just as a (temporary) CSR activity. Moving from a partnership with a CSR-oriented division of a large player, to the actual player itself, is a challenging process. This problem can partly be eliminated by formalising the agreement (Letter of Intent) that indicates they will transfer it to their core business when the pilot is proven successful.

3.2.8. Increased competition

One important business challenge is **dealing with increased competition**. On the one hand, this is good news, since this means that digital services are attracting attention and funding thereby accelerating innovation and scaling. On the other hand, however, this is confusing the (potential) customers and might make them switch from one app to another app. There even is a risk that customers become disappointed from all these (starting) innovations and will stop to use them. Customer retention in this competitive environment becomes a major business objective. That means that partnerships should continue and increase user engagement and training activities.

3.2.9. Other challenges

Even if customers can be retained, and the business shows a long-term commitment, there are always additional challenges that emerge both within and outside of the partnerships. For some of the parties involved, such as specialised data providers and local private companies, increased market readiness for digital agricultural advisory services may result in new opportunities. For other partners, it may result in limited options to scale due to increased competition.

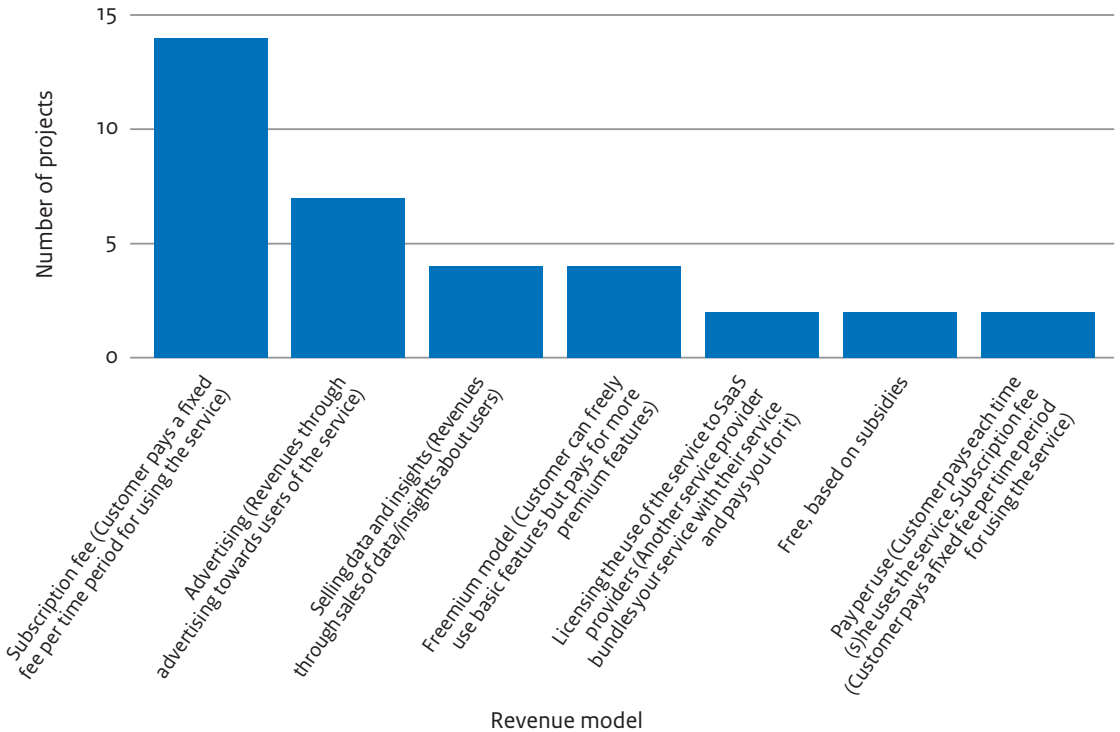
While processing of satellite data is still highly specialised, this can be expected to be taken over by local remote sensing partners in the near future. The main bottleneck remains clarifying the intellectual property rights (IPR) in relation to the algorithms used and creating licences that are agreeable to the different stakeholders involved. Other roles, such as platform hosting, marketing and sales, can more easily be taken on by local companies. The business owner in G4AW has the freedom to continue with the required and desired partners to create a sustainable business model. This long-term process largely depends on the entrepreneurial skills of this business lead, although during the project phase, it already showed to be challenging to **keep all partners satisfied**.

3.3. Business and revenue models in G4AW

Most of the G4AW partnerships have started with the ambition to sell services in B2C models via designated existing service providers or new established social enterprises. There are still some services from G4AW partnerships that are being marketed in B2C. Most partnerships, however, have also added a B2B approach to create additional and more stable revenues. When asked which business approach would be more lucrative, about 75% of the partnerships said they expect to make more profits on B2B than on B2C operations. Almost half of the partnerships said they are planning to change their business approach and add a B2B component to their existing business model.

The most common revenue model, which is used by over 50 percent of respondents, is a subscription model. In this model the "customer" pays a fixed fee per time period (often annual) for using the service (shown in Figure 10). The customers in these business models are often businesses. Advertising follows with about 30 percent of respondents. Alternative revenue models, such as licencing, the freemium model or selling data and insights generated from the services, are only adopted by a few projects. However, almost 70 percent of business owners indicate that they still plan to change or add revenue models.

Figure 10 Revenue models currently in use by partnerships



Potential business models are strongly linked to the type of services provided, which are again influenced by the service delivery methods. Available service delivery methods also strongly different between Asia and Africa, with more smartphone and social media use in Asia (see Lessons Learned part 1). For example, business models based on pay-per-use need to provide services that are unique to smallholders' conditions. Periodic subscriptions require the service to be relevant throughout the year (e.g., more accurate weather information than received via other means such as radio), as otherwise farmers will cancel the subscriptions. The possible relationship between selected business model and a) service category; b) region; and c) crop and commodities are explained in the next sections.

3.3.1. Linking business models to service types

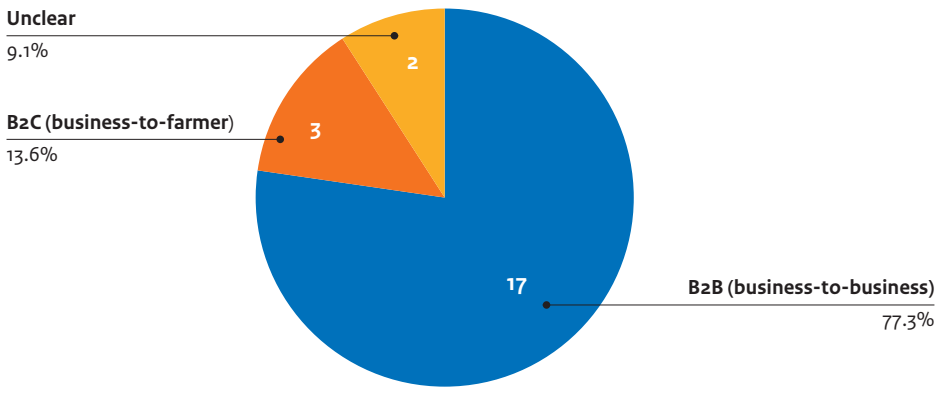
There are four general service categories created by the G4AW partnerships: agronomic advice, weather information, crop insurance, and financial access. Each service contains different elements that make them suitable for a certain business model. For example, weather forecasts have a large potential user base, which make it suitable to include advertisements.

A challenge when trying to find a link between the created G4AW services and suitable business models is that most G4AW partnership have created services in different categories (e.g., agronomic advice and weather information). At the same time, many partnerships still have not given up on certain business models, even though they contribute little to overall revenues. Many mention they are focusing on a combination of several different models, without indicating the priorities. This means that the relationships found only give an indication of the current interest, and not the actual division in share of created revenue.

When looking at the category of the current key-selling service[13] , as put forward by the partnership in the BopInc survey, the relationship between business models and service categories is presented in Figure 11. The simplest revenue models can be seen for crop index insurance (although this is based on only four projects), as income is generated through three different models: the insurance premium (partnerships receive a percentage of total insurance premium supported by the services), subscription fees (and insurance company pays a subscription to use the services), and subsidies (the government subsidises the insurance, so farmers have to pay less). Many of the other business models (advertising, freemium, licensing, pay-per use and selling data and insights) are less relevant for crop index insurance.

For weather information, five different business models are used. Three of these categories (subsidies,

Figure 11 Business model considered to create most revenue for services



13 *The business owners provided their unique key-selling service in the BopInc survey, which have been categories according to the initial user categories in G4AW (e.g., nutrient advice has become agronomic advice).*

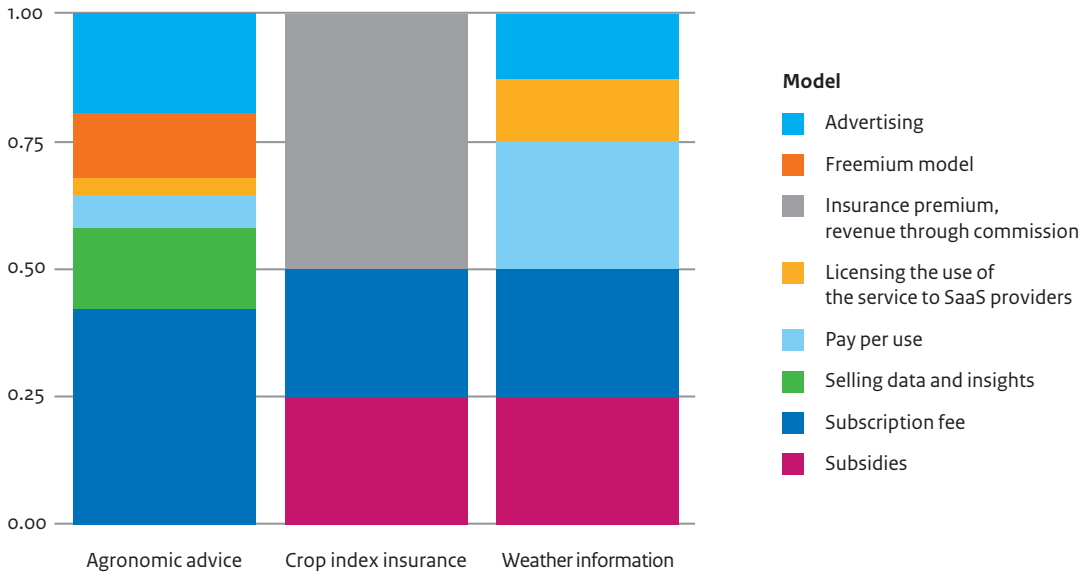
subscription fees, and pay-per use) are applied in 25% of business models. The other business models (both 12%) are advertising and licencing the use of Software as a Service (SaaS). SaaS is when the customer does not have to purchase the software, but is charged for use in a certain period. This is often done for business intelligence dashboards. While the variety in business models is quite large, there is still a general focus on relatively simple models. Selling data and insights is generally not possible, as there is limited user-specific information required to provide accurate advice compared to more specific services focused on agronomic advice and financial access.

For agronomic advice, six different business models have been used. The dominant model (40%) is subscription fees. In many cases, an agribusiness pays for the services. Subsidies have not been provided for any of the agronomic services. As subscription fees are generally not sufficient nor sustainable to close the business case, many other models have been included. With 20%, advertising is the second most used business model, followed by selling data and insights, a freemium model, pay-per use, and licencing the use of the service to SaaS providers.

An obvious difference of the business models included in services focused on agronomic advice compared to the two other categories is that subsidies have not been available for services focusing on agronomic advice, while this has been the case for crop index insurance and weather information. The main advantage of weather information is that pay-per-use can be an important part of the business model, while this has not been an important model for agronomic advice. The main advantage of crop index insurance is that partnerships can get sustainable and significant revenues from commission on the sold insurance.

The main potential of agronomic advice, is that a lot of data is available regarding precise plot locations, farming assets, and historic and current production. This could be highly relevant for certain enterprises, making selling data and insights an interesting additional business model. In practice, however, the switch is not easily made as selling data and insights requires a lot of users and accurate and frequently updated information. Another challenge is related to the increased legal restrictions related to use of personal data in such services. Some data gathering can be automated by using satellite data, but as smallholders often cultivate different crops and plots in different years, a lot of checks have to be added to ensure data accuracy.

Figure 12 Revenue models per service category



3.3.2. Revenue models per crop and commodity

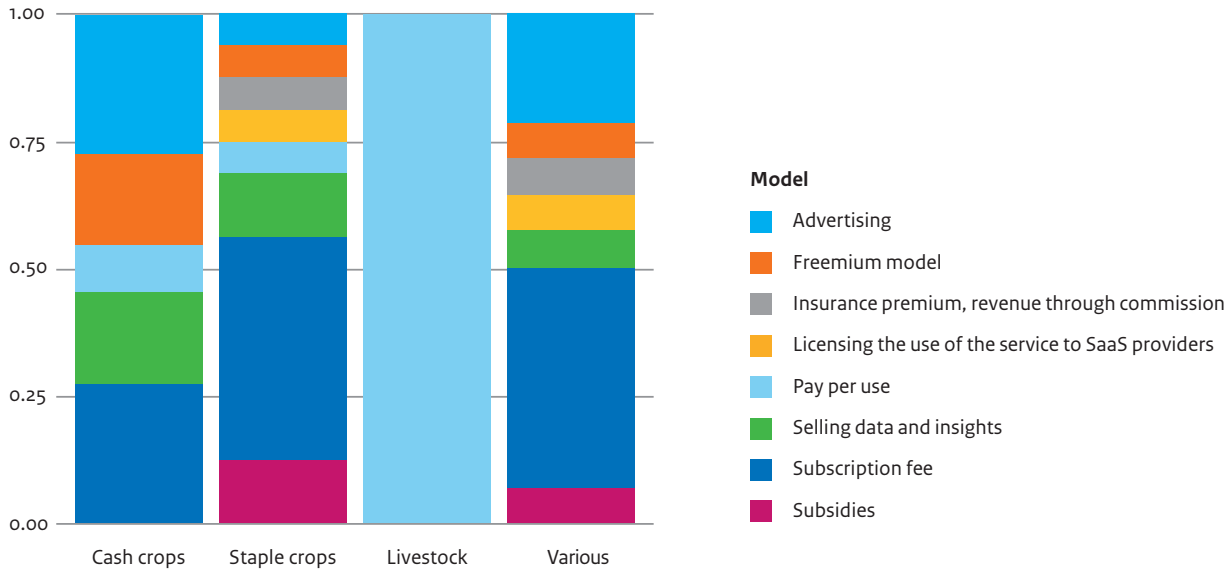
Business models are also strongly related to the targeted crops and commodities. A focus on marketable cash crops will automatically attract more business interest than a focus on crops for local consumption. The highly seasonal demands of (agro)pastoralists (the need to find water and fresh biomass in dry season) will limit the potential of subscriptions and is more likely to be linked to a pay-per-use model. The current link between crop/commodity (divided into cash crops, livestock, staple crops and various crops) is shown in Figure 12. Especially the 'various' group can contain very different crops. In some cases, these are different vegetable crops, but in other products, this can be a combination of cash, vegetables and staple crops.

Figure 13 shows that especially for products for (agro) pastoralists (livestock), the business models have been simple. These are only two services in West Africa (MODHEM/STAMP) that both still use a pay-per-use model. These projects are also considering to add more (B2B) models, but this is still very challenging due to lack of markets and internet connectivity. B2B models work best when the service provider can provide relevant insights about farmers. These insights are best gathered when using a smartphone app with two-way communication.

Business models for staple crops and various crops are relatively similar. Both can still benefit from subsidies, and rely on subscription fees. Subsidies and subscription fees together form 50% of business models for these crops. For various crops, a lot more focus is placed on advertising. An explanation could be that when targeting a larger variety of crops, different sources of advertising become relevant, as different crops require different seeds and other inputs. Services for various crops are often more general (e.g., weather information), which means that the detail of the farmer registration is low and are thus not very valuable to provide relevant insights.

For cash crops, five different business models are currently being used. The most important ones are subscription fees and advertising (> 25%), followed by selling data and insights and a freemium model (~20%). Pay-per-use is also used, but this is very limited (10%). Selling data and insights as a business model is implemented more in services focused on cash crops than in the other crop groups. This could be because farmers cultivating cash crops are more interesting for financial institutions as income is higher, and the farms and farmers are generally registered with a high level of detail.

Figure 13 Revenue models per service crop or commodity



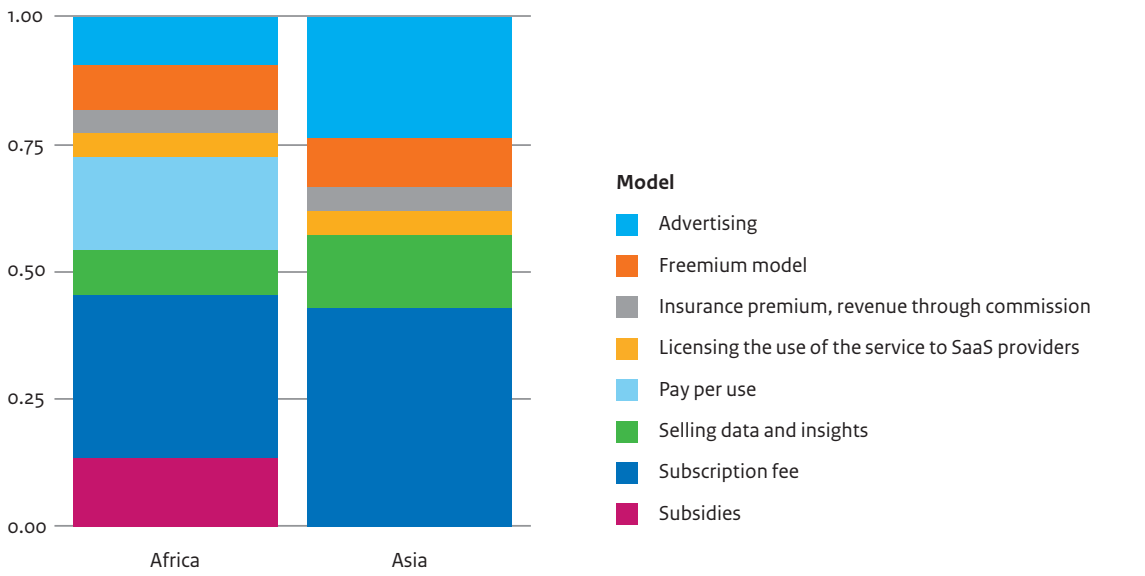
It is not clear from this data what the share of income has been (or is expected to be) that is generated from these different business models. It simply shows what business models the partnerships are currently expecting to be successful for them. It could be that subscription fees contribute less to total revenues than the share they have in the business plans of the partnerships. This lack of a dominant business model (as has been the case for the other crop/commodity groups) can result in difficulties to find a clear direction, which could hamper scaling up and finding investors. Partnerships have frequently provided updated business projections (cash flow) in which they had to clarify current and projected income from different revenues. This included information about the number of clients or business customers and the costs charged for different activities (e.g., farmer or business subscriptions or advertisement). This level of detail has helped to make the picture more realistic.

3.3.3. Regional differences business models

The previously discussed factors (selection of service categories and crops/commodities) that influence the business model opportunities also differ per region (Africa vs. Asia). This is also discussed in the first G4AW lessons learned publication. Regions vary a lot when it comes to the current state of financial access, service delivery method, cultivated crops, network access and more. At the same time, the overall business framework between Africa and Asia is very different, with a larger role for agribusinesses in Asia, and of financial institutions and telecom operators in Africa (social enterprises play an equally large role in both regions). If there are no large agribusinesses present in a region, this will limit the potential of business models that embed costs in the sales of agricultural inputs such as seed, fertilizers, and pesticides. Figure 14 shows how business models vary between the regions currently.

The main difference between the regions is that government subsidies are more easily available as part of the business model for services in Africa. At the same time, advertising is more commonly used in Asia. This is largely due to higher degrees of smartphone penetration in combination with more developed value chains and higher disposable income that the users can use to purchase inputs. Additionally, more services in Asia are focused on agronomic advice due to the stronger presence of (large) agribusinesses that are willing to pay for the services (either directly through subscription fees, or indirectly by paying for ads).

Figure 14 Revenue models per region



Pastoralist, herding cattle in Mali ©SNV/G4AW STAMP project

Pay-per-use is not used as a business model in Asia, but is still used in different partnerships in Africa. This is mainly related to the two projects for (agro-) pastoralists in the SNV-led projects in West Africa. This is also partly because of the service delivery methods: in Africa, data is often accessed by feature phones (either by call-to-call centre or by sending text messages). Other business models such as advertising are generally easier to link to the use of applications on smartphones. Another difference is the selling of data and insights. This is more commonly done in Asia than in Africa due to the use of more advanced service delivery methods. When using smartphone applications, it is easier to request additional information from farmers and verify their location (e.g., ask farmers to verify by using a map viewer) compared to when using basic phones to reach smallholders.

The biggest learnings about how to develop a viable business case for the service offering are: the focusing on B2B clients that pay for the service rather than a sole focus on B2C, and bundling the services to optimise the value for the target groups.

> *"Avoid a B2C model as smallholder farmers are not willing to pay for information service even if they have seen the value of the product and also have the means. To succeed with a B2B model, you may need to strengthen your value proposition around data for other agribusinesses to pay, instead of the smallholder. You may also want to bundle information service with some other tangible product or service such as inputs, energy equipment, loan, etc."*
>
> **MUISS, Uganda**

4. Commercialisation and Scaling

Commercialisation is the final stage of creating a sustainable business. After commercialisation, scaling can help to increase the size of business operations (e.g., more staff, new business partners, other regions), and help to reach more smallholders. Commercialisation in relation to G4AW initiatives requires different factors to be in place: 1) a healthy partnership with clearly defined roles and entrepreneurial leadership, 2) optimised services (desired service proposition), 3) a good product-market fit (viable business case), and 4) a functioning business model. Commercialisation is the final push to bring these elements together and bring the product to the market. This is the final transformation from partnerships to entrepreneurs.

To understand what stage the business idea in each project has reached, BopInc presented three checks in the 2020 survey, that are believed to support successful commercialisation of a service innovation (see Table 2). Respondents were asked to study the three checks and then evaluate to what extent they had each check in place.

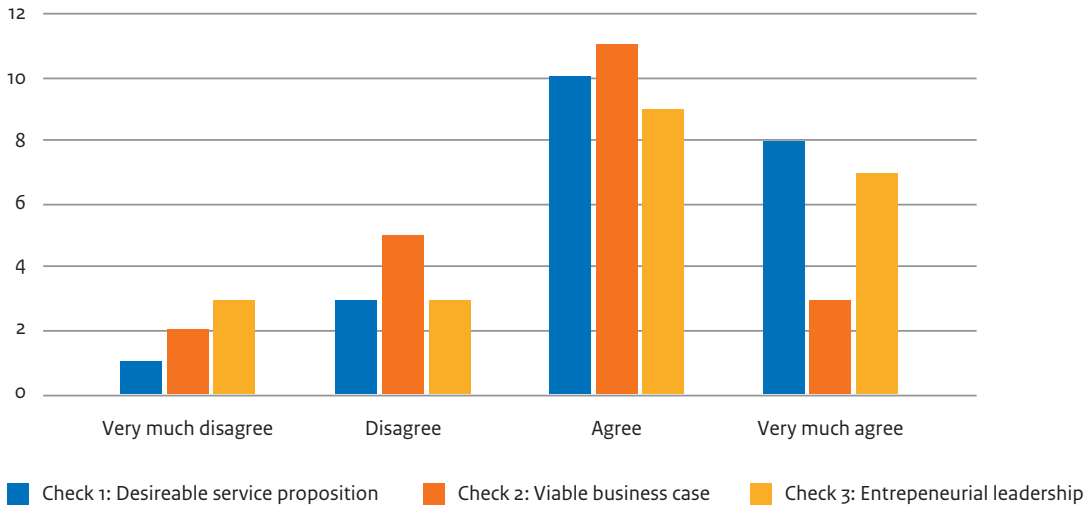
In general, respondents appear to be confident about the three checks being met already (see Figure 15). Most respondents give themselves a positive score on all business elements. They (very much) agree with the statement that they have a desirable service proposition, a viable business case, and good entrepreneurial leadership. A closer look at the results shows some differences between how each check was applied.

From the three checks, check 1 ('we have a desirable service proposition') appears to be the most developed one according to respondents. Reasons for respondents to assign slightly lower scores to check 2 ('we have a sound business case') are: the willingness to pay for their service has not been sufficiently proven among their (in)direct customers, they best revenue model has not yet been identified, or the project or business leads continue to rely on donor funding.

Table 2: Three checks for commercialising the service innovation

Check 1	We have a desirable service proposition with a clear added value for the target group, which is demonstrated by a successful pilot. A significant % of end-users in our target group report that they actively use the service and experience the benefits we promised to them.
Check 2	We have a viable business case with a revenue model that can finance our operational expenses as well as the growth of our business, without relying too much on grants/subsidies. We have good relationships with our first customers that show willingness to pay (and keep paying) for this service.
Check 3	We have entrepreneurial leadership within our (project) team and there is agreement about who can sell and make money on the developed service. The entity that is leading the business development activities has the capabilities, partnerships and commitment to realise success.

Figure 15 Self-scoring by projects on the three checks



An important reason mentioned for the lower scores on check 3 ('we have entrepreneurial leadership') is that many of the partnerships have not yet appointed or found an entrepreneurial team that will launch and scale the service in the market. Some teams indicate they have an entrepreneurial lead, but this lead still requires additional competence building (e.g., mobilising resources, taking initiative, spotting opportunities)[14]. Respondents from the G4AW projects in Asia generally score themselves higher for check 3 ('we have entrepreneurial leadership') as compared to their peers in Africa who generally have lower scores for check 3.

4.1. Commercialisation Readiness Levels

After partnerships had scored themselves on the three checks, they were presented with three Commercialisation Readiness Levels (CRL) based on this. The respondents were asked to study the description of each level and evaluate which one best describes the situation their business idea is in.

Table 3: Commercialisation Readiness Levels for the service innovation	
CRL 1	**Level 1: Not ready for commercialisation** At this level, the partnership operates in a project mode with disagreement or indifference about whether or how to transform the developed service into a business. The project might come to a hard stop and project partners may decide to continue to work with the project's idea and learnings on their own.
CRL 2	**Level 2: Transitioning to commercialisation** At this level, the project partners have (only recently) agreed on who is the business lead and defined the roles of the other partners in this business model. With the roles defined, the entrepreneurial lead is in the process of optimising the service and the business case.
CRL 3	**Level 3. Ready for commercialisation** At this level, the leading entrepreneurial entity and business partners in the project have verified the commercial viability of their business idea. There is a significant group of paying customers in the pipeline. There is also a clear strategy and plan for attracting investments necessary to scale the business.

14 *Publications catalogue - Employment, Social Affairs & Inclusion - European Commission (europa.eu)*

"Based on the experiences gained during the service delivery pilots implemented with the support of G4AW, Lal Teer has acquired profound understanding of the potential and possibilities of the market for agricultural services. We have a commercially viable business case with clearly defined service propositions. All the service components are developed and there is a clear understanding among the partners. The target customers are well defined. Moreover, considering the affordability for the farmers, different service packages including different facilities have been developed."

GEOBIS, Bangladesh (on CRL Score 3)

Similar to the scores on the three checks the respondents gave themselves rather good scores on their commercialisation readiness. See Figure 16 below.

Half of the respondents in the survey indicated that they are at CRL 2 'Transitioning to commercialisation'. Only four respondents say they are at CRL 1 and qualify their business idea 'not ready for commercialisation'.

Seven respondents are very positive and assigned themselves the highest CRL score 'Ready for commercialisation'. There is no significant correlation between the CRL scores and the project start year or service type. There appear to be some regional differences however, with projects in Asia showing more projects at CRL 3 than in Africa.

Figure 16 Self-scoring by projects on the commercialization readiness level

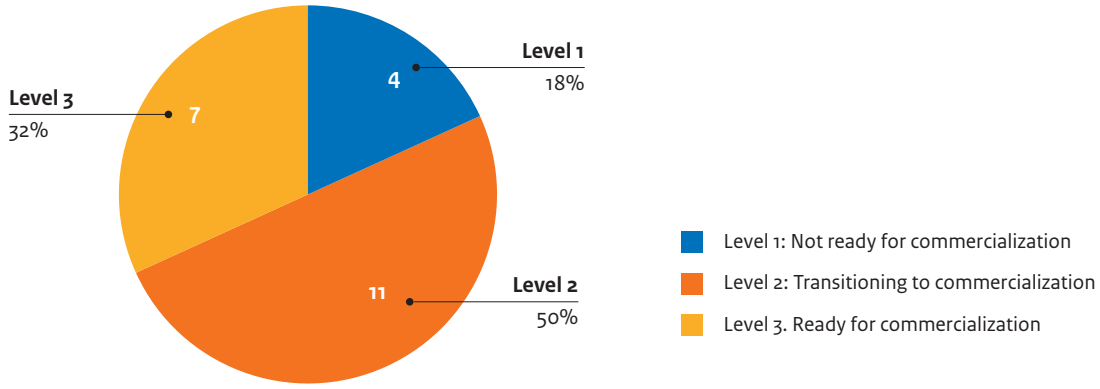


Figure 17 Regional difference in self-scoring on commercialization readiness level

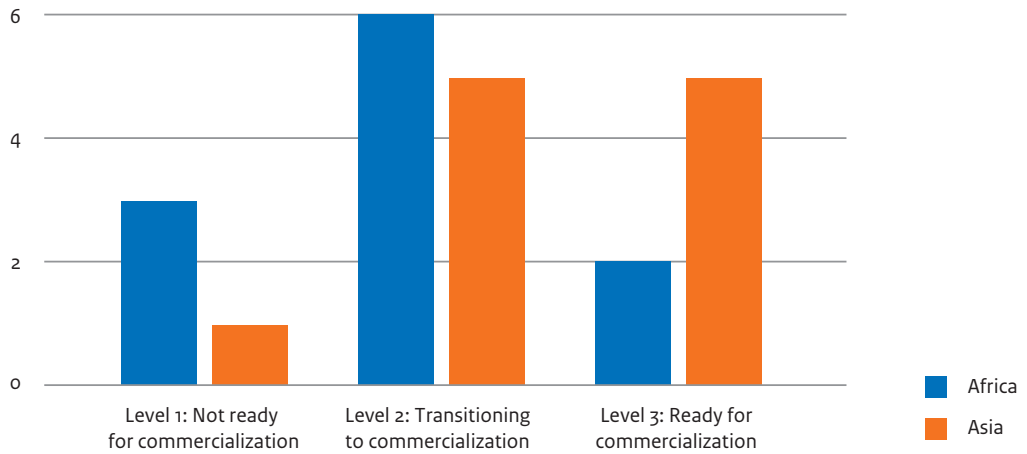
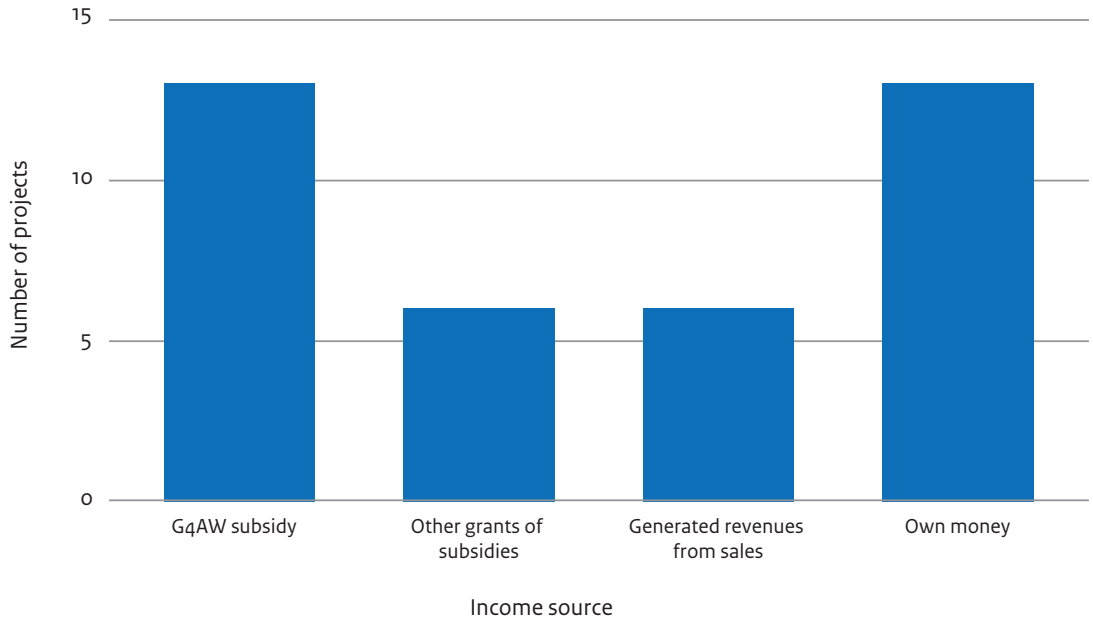


Figure 18 Current way of financing the business operations



From those that assigned themselves a CRL below 3, two out of three of respondents are confident that they can graduate to the next CRL with the current G4AW project partners and the resources that they still have available. Most of them indicate they need less than 2 years to achieve this.

Around a quarter of respondents are not confident they can graduate to the next CRL because of various reasons mentioned such as: increasing competition, a decrease in market demand for their service, lack of funds, lack of leadership in the partnership, and political instability or crises in the country they operate in.

> *"The foreseen barriers to get ready for commercialisation are new competitors, cost of services provision increase (satellite data, soil mapping, weather information), change in government policy towards data management and privacy of the country, and natural disaster or pandemic."*
>
> **Angkor Salad, Cambodia**

Sixty percent of respondents indicate they will continue to rely on grants and/or subsidies on premiums in the near future to finance their service improvement and business development activities. However, even when the service is fully ready and launched in the market, 55% says they will keep on requiring grants as they assume their service cannot sustain through sales revenues alone (see Figure 18). This shows that the market is still immature, the service sector is still very young and it is difficult to expect standalone business models to already emerge; a mix of public/private money will probably stay necessary in the coming years, until the market has become more mature.

4.2. Barriers to commercialisation

At the time of the survey in late 2020, the project and business activities of respondents are mostly financed through the G4AW subsidy and their own funds. A few

managed to add grants/subsidies from other donors than NSO. These funds are important to help the business leads finalise the product and their business plan. It is positive to see that 27% of respondents mentioned they already finance part of their operations through sales of the newly developed service. This shows early signs of commercial viability.

What is much more remarkable, however, is that more than half of the respondents mentioned that even when the service is fully ready and launched in the market, they will keep on requiring subsidies. This means that many of the business models developed are not optimised to be sustained through sales revenues alone. These projects face risks of not having sustainable financing. In this section we present, what we consider to be, the top-5 barriers for the successful commercialisation of the satellite-data based services developed in the G4AW projects, as found from the survey conducted with 24 of the G4AW partnerships in 2020.

Top-5 commercialisation barriers identified:

1. Lack of pipeline with (larger) paying customers to ensure stable and sufficient revenues
2. Long term reliance on subsidies, even when commercially launched in the market
3. Insufficient entrepreneurial leadership
4. Lack of business competences
5. Not taking a user-centred design approach to convert farmers into active users

Commercialisation barrier 1: Lack of pipeline with (larger) paying customers to ensure stable and sufficient revenues

Most G4AW business leads agree that a B2C business model is extremely challenging for these types of services, particularly after learning that smallholders are often not willing to pay for subscriptions. This is becoming even less likely in the future as more free services such as weather forecasts are provided.

B2B is the model of choice, as 75% of the respondents said they would make more money on B2B operations than B2C. Not all projects had (fully) developed the B2B model, but many say they are working on this. Changing the mindset from a (single) smallholder approach to a (broader) value chain approach takes time. It appears that projects struggle to differentiate between end-users and paying customers, which are two distinct target groups that need to be served in different ways. A further next step would be to go from a bundling of services to a 'platform' of services which combines agri-advisory services with financial and market services.

In conclusion, we can say that most G4AW projects realised during the implementation of their project that the task is not only to develop a new service which did not exist before, but also about developing a market for these services. The value of G4AW projects is that it clearly showed the potential for these services but it will take (more) time and efforts to develop the associated market.

Commercialisation barrier 2: Long term reliance on subsidies, even when commercially launched in the market

Also significant is that few respondents mention the possibilities of attracting venture-capital. Given the nature of the disruptive technology of G4AW, venture-capital could give entrepreneurs the opportunity to further develop their services, business case and advance to reach scale. We believe the reason for not mentioning this is that G4AW projects are more familiar with subsidies and less with the demands of (impact-) investors.

While many respondents said they have implemented cost-saving strategies to improve commercial viability, one-third is not sure whether the cost-optimisations have been or will be sufficient. Business leads may want to consider more aggressive approaches to make the business leaner and take inspiration from others that have explored: cost-sharing with other parties, optimising the number of staff in the core team and replacing Dutch staff by local staff, and replacing existing service providers (from the partnership) by more affordable ones.

Commercialisation barrier 3: Insufficient entrepreneurial leadership

Many projects did not propose a lead entrepreneur in their partnership at the start. As a consequence, these projects became technology-driven rather than demand-driven and struggled to work towards a clear vision for commercialisation. In theory, a (large) partnership brings the best of expertise in different areas together: knowledge about local conditions and entrepreneurship. It takes time, however, to build trust among partners and to align their different interests to work towards a common goal.

Despite this unfavourable start, most respondents said their partnership has agreed on who will lead commercial sales of the service that had been jointly developed. In most cases this is a social enterprise or for-profit company, and a party that was already part of the original partnership. In a few cases, the business lead is a newly identified party that was not part of the original partnership or a newly established entity by the partnership itself.

Having such leadership is extremely important, not just to secure continuity but it appeared that a lack of such leadership led to partners dropping out of the partnership or no longer being committed to long-term success. Having the entrepreneurial leadership in the markets in which the service is operational helps embed the embedding of business operations (players in the Netherlands are too distant from the market and sometimes too expensive for the business to become viable).

Commercialisation barrier 4: Lack of business competences

As mentioned in the previous section, many projects struggled to assign an entrepreneurial lead that takes responsibility for commercially selling the newly developed service. For those projects that (eventually) identified a business lead, various respondents indicate their team still requires better entrepreneurial competences. From many of the answers given to questions in the survey it becomes clear to us that the teams are still largely operating as project teams, and not entrepreneurs. To give an example, when asked what barriers they face in commercialising the service, respondents mentioned things like increasing competition, changing demand, or the lack of funds. These are of course the realities of doing business in low-income markets, and with good entrepreneurship the business leads should become aware of these and develop strategies to timely adapt their business strategies based on their awareness.
Looking at the most important business competences

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to build, it is not just the legal form of the business entity that is important (i.e., for-profit or social enterprise) but how to build a capable team to run the business in an emerging market.

Commercialisation barrier 5: Not taking a user-centred design approach to convert farmers into active users

Many respondents scored themselves high on the desirability of their service proposition for the target group, and some of them explicitly stated that the traction generated among farmers in the project is a great achievement. However, when taking a closer look at some of these claims, it seems many are made on the basis of the number of farmers that subscribed to the service. Number of subscriptions is not a metric to evaluate customer satisfaction on. Better metrics are number of active users, recurring customers, net promoter scores, and livelihood improvements associated with the service.

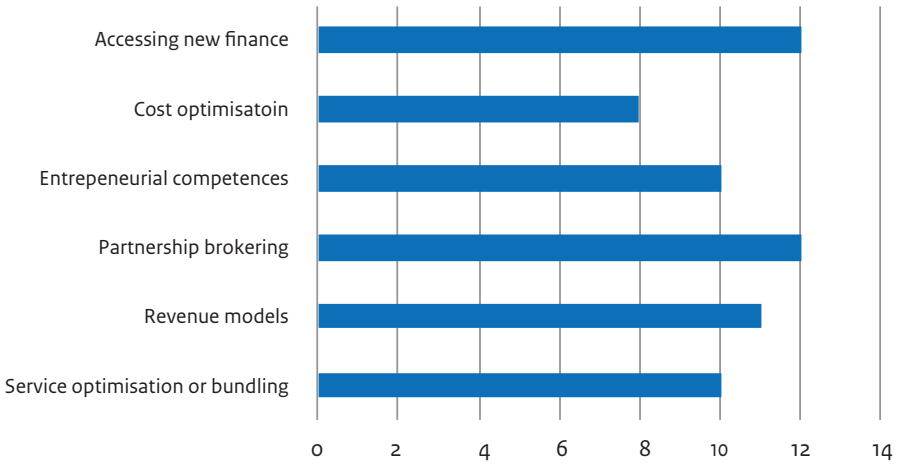
Although the bundling of services has received a lot more attention in the projects, various respondents mentioned their project failed to bundle their service with other services. They rightfully mention that a single service offering is not as desirable for farmers as a 360 degrees service. To be specific, telling a farmer to buy better but more expensive seeds is not sufficient when the farmer is not told at what retailer he can purchase this, how he can finance this, and at what markets he can sell this new variety (at the best price). It is essential that the business leads find ways to combine services that support smallholders and other value chain actors in all three areas: access to (1) agro-advisory, (2) finance, and (3) markets.

In conclusion, all respondents agree that their service(s) still need improvements to maximise the value for the target group, which is considered necessary before launching the service commercially at scale.

4.3. Business needs

In 2020, BopInc asked the business leads in G4AW what technical assistance they would prefer to meet their current business development needs. Six different options where provided, ranging from service optimisation to accessing new finance. While almost all options were in clear demand (several partnerships require support in all areas), there is a clear demand for support that is most relevant at a high commercialisation readiness level (accessing new finance and partnership brokering) (see Figure 19). Support in these areas is most relevant when the service is already optimised, with clear revenue models based on sufficient entrepreneurial

Figure 19 Prefered support for business development



leadership. These are also responses that place the needs outside of the partnership: the partnership is ready, but simply requires new partners and/or finance to scale towards a sustainable business.

While for some partnerships, the services and revenue model might indeed be ready, in most cases there are other steps that need to be taken first. These internal steps are to optimise costs, build entrepreneurial leadership, select revenue models and optimise/bundle the services. If these steps are taken and the service is sufficiently unique (limited competitors), it can be expected that new partners and finance will automatically follow. The partnerships that focused on these internal issues, and made their 'homework' during the technical assistance trajectory, are also the partnerships that (in many cases) have been successful in subsequently attracting new partners/finance to scale.

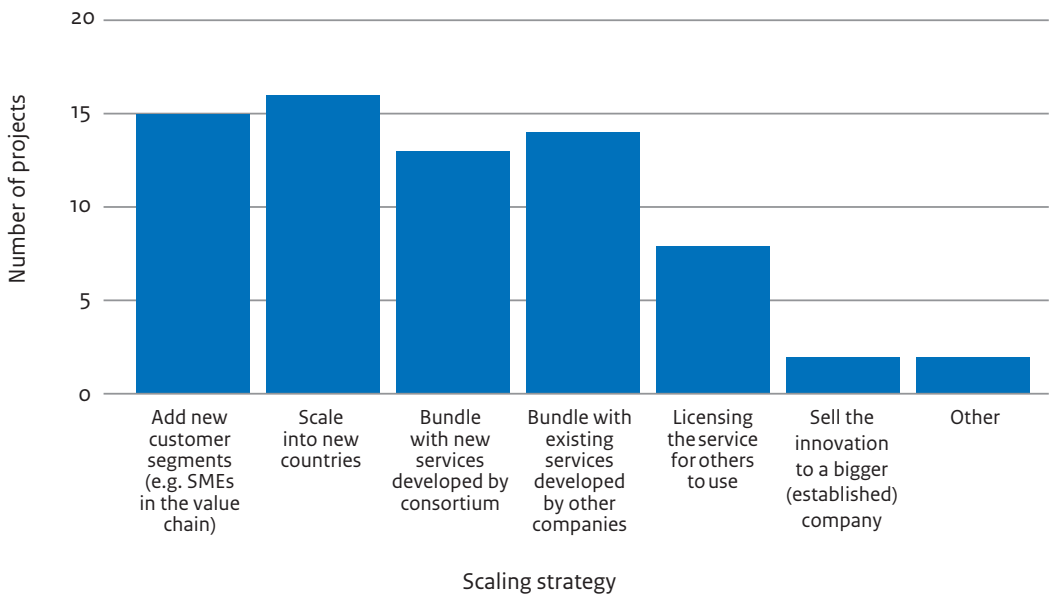
In order to access finance, it should also be sufficiently clear what investors need. A reverse Investor-Pitch, in which a potential investor explains how they look at a business plan, has been part of the technical assistance to make the business leads understand what investors are looking for in companies that provide digital advisory tools to farmers. It is important to have clear and realistic numbers when it comes to (active) reach, costs and revenues. Business models are important, as is having a strong business lead with a clear strategy and vision. Several partnerships have established social enterprises to continue the services and ideally also attract investment. The social enterprises are based on a 3-to-4-year G4AW project and generally continue to receive (in-kind) support from a set of the partners for several years after the project ends. It is assumed that these partners (after 5-6 years total) have the numbers and vision to attract new funding that will help them to further scale without continuing support from the initial partners.

4.4. Scaling

When asking partnerships about scaling plans, the most common scaling plans mentioned are: scaling into new countries (73%), adding new customer segments (68%), and the bundling of services by either expanding their own offering (59%) or by integrating the service with those of 3rd parties (64%). Many respondents do not consider selling the innovation entirely to another company, which means most have the ambitions to continue selling the service themselves. See Figure 20 below.

Two respondents mention that they have no plans to scale. These projects both had a strong focus on research (large role of university) and less on the business continuity.
The ambition to scale it related to the strategic priority

Figure 20 Most common scaling strategies by projects



of the business owner. If this is an international trader in certain commodities (e.g., Verstegen Spices & Sauces), it is expected that scaling to other countries that produce these commodities is of interest. For the larger agribusinesses, the main interest is generally on the national market, as the organisations are often based around working at this level. For these companies, it is more interesting to bundle services and reach more areas within the country. When data-focused companies are in the lead, the main interest is generally to sell this data to any interested party that can use this data. There are not boundaries based on data availability, although when the product involves converting data to insights about a certain commodity, scaling will be limited to the geographic coverage of this commodity. For more general information, such as flood-warnings and weather forecasts, scaling is flexible. Increasingly more data-focused companies also have priorities related to sustainable development. This means that they do not simply follow the money, but also have clear demands about how their data will be used to contribute to their own objectives.

The scaling plans rely on various assumptions such as: (1) the availability of funding to finance the scale-up, (2) the availability of interested partners in other countries they want to scale in, (3) the assumption that replication will work under the same operational costs and procedures, and (4) the assumption that there is enough demand and willingness to pay among new customers they will identify. These reasons are thus highly diverse, and range from long-term strategic (one-stop shop) to an absolute necessity based on the selected (niche) crop such as pepper. There is a lot of ambition in the G4AW programme when it comes to scaling of services. Quite surprising is that 75% of business owners already plan to scale to new countries. While this could be very interesting, this is not necessarily in line with the initial objective of G4AW. For example, the available project budget cannot be used for commercial activities outside of the initial target country/countries. Activities in other countries can be subsidised, but only if these strengthen the service in the initial target country (e.g., attending scientific conferences focused on digital services). This limitation to use funding in other countries has had an impact on partnerships that intended to use G4AW funding to scale to new countries within the duration of the project.

> *"Pepper and Indonesia alone are not enough to sustain our business and growth. Exploring new segments and countries is needed to increase the importance of SpiceUp in the industry."*
>
> **SpiceUp, Indonesia**

Several G4AW projects have been able to do projects funded by third parties in other countries, but in most cases, these have been relatively small pilots. The struggle in these smaller pilots is how to create realistic promises when it comes to the timeline and accuracy. Scaling to new countries does not only require potentially finding new service providers, but will also require a new licence to operate, and calibration and validation of the service to the new agro-ecological zones. At the same time, even when the business partner has the same interest, this is not necessarily the case for the smallholder users. When smallholders are not involved in these scaling efforts (new user-centric design), the benefits of the scaled services are limited, as a lot of the relevant information is derived from farmer involvement. Partnerships are learning from any potentially failed effort, resulting in a more realistic promise to partners in new countries. This can result in more successful efforts in the coming years.

The G4AW projects in the Sahel with SNV in the lead, which started in Mali (STAMP) and Burkina Faso (MODHEM) have been the most successful in scaling by bundling services and reaching new areas. Scaling of these projects has been done both vertically (adding financial services) and horizontally (a new project in Niger from 2021). It has to be noted, however, that scaling for these projects has been enabled by additional subsidies from different development agencies, and not by private (own or business) funding.

As the G4AW funding cannot be used to scale to other countries and business owners are generally aggregators such as agribusinesses, the practical experience shows that the business owners have a strong focus on scaling within the target country (adding new customer segments and bundling with new/existing services). In order to scale to new countries, many partnerships have submitted proposals to grants or subsidy programs. Even if these possible new projects might be seemingly quite different and not primarily focused on use of satellite data, it has become clear that many of the business leads are willing to (re-)use the developed digital tools and created advisory services in G4AW. This results in scaling of services to other programmes (and hopefully also the resulting services) and less initial costs for development.

5. Recommendations

5.1. Creating a balanced and involved partnership

A successful partnership has to be rewarding for all partners involved. This means each partner has to contribute towards and benefit from the creation of shared value. It is important that the partners identify a resource or asset they can bring to the partnership, which can complement or enhance the resources or assets of other partners. It is also important to understand the reason why partners want to be involved to understand the timeframe of their involvement (short-term or sustained). The roles and agreements (including on intellectual property and business ownership) need to be clarified and formalised to ensure a transparent cooperation process. A partnership needs to be flexible and be able to adapt to changing conditions.

5.2. Ensuring sufficient entrepreneurial leadership

Entrepreneurial leadership is one of the most important preconditions for commercialisation and scaling of services. This entrepreneurial leadership has varied throughout the G4AW calls (limited in early calls, high in the most recent call). There is generally less entrepreneurial leadership in the G4AW projects in Africa than in Asia. This can be increased partly through entrepreneurial competence building. But in all cases at least one of the partners should have entrepreneurial skills or be willing to take on the role of entrepreneurial lead and – if necessary – acquire sufficient entrepreneurial skills. This partner should preferably be located in the targeted country, or have its own business associates in targeted countries.

Many G4AW partnerships envisage the establishment of social enterprises, and a few have already done this. This will transform and formalise part of the partnership. This process, however, can be time-consuming and relatively costly. It is important that the partners begin this process early on in the project, to ensure that there is no (time and financial) gap after the project ends. Whether a social enterprise is the right form depends on the type of product and the objectives of the business owner, so this is not relevant to all partnerships.

5.3. Optimising services

Meeting the needs of many users (smallholder segments and businesses) can be done by bundling services, and by having a dynamic and easy-to-use front-end (e.g., app for smallholders, dashboard for business. Reducing costs can be done by collaborating with other partners, using cheaper or open data, and replacing international staff with local staff. The implications of these cost reductions need to be well understood to ensure that cost reduction does not result in a smaller user base (and even less revenue).

It is also important that the partnerships do not overestimate the (rate of increase in) network coverage and smartphone access. In different projects, significant additional expenses had to be incurred to add more offline features, as farmers could not access online advice. While this is expected to improve in the near future, it is important to focus primarily on the current conditions, while keeping in mind future developments.

An additional challenge in the optimisation of services was that the number of growing seasons for testing has been limited in most projects, as the minimum viable product was generally only ready in the third year. In addition, the organisations that would use and/or sell the services were not all equally ready for digitisation at the level of using digital tools.

5.4. Understanding smallholder needs

Smallholder food producers, whether they be farmers or (agro)pastoralists, are the end users and beneficiaries of the services. In order for them to use the service, it has to be clear what challenges they face, and what options they have to solve these. It is important to understand the different user segments (gender, age, finance, specific needs). It is also important to understand what actions farmers are willing and able to take (user stories), and what products are available on the market (market study), to ensure that the information or advice provided is actionable. A user-centred design is required to better meet smallholder needs and ensure customer satisfaction and retention (see 5.8).

5.5. Financial services

The objective of financial services is to provide farmers with affordable credit and/or insurance that enable them to invest more in their farming activities, and thus increase their production and self-reliance. While geodata has been proven beneficial for the provision of financial services such as credit scoring, the revenues are still relatively low and require scaling to be sustainable. Bundling financial services with agricultural advice and/or risk management is advisable. Bundling with agricultural inputs is also an option (E.g. as done by Pula and One Acre Fund).

5.6. Understanding the value of client and crop data

The G4AW partnerships have collected a lot of data. This includes, amongst others, the registration of farmers (and pastoralists), plot delineation and crop types. Quite late in the G4AW projects, many of the partnerships started to understand the value of this data. Farmer registration, for example, is of interest to financial service providers and agribusinesses. The data related to plot delineation and crop types is also of interest to businesses, but also holds a lot of value for research purposes. It is important that partnerships understand the value of data early on in the process, and ensure that data is complete and validated. It should be well documented (metadata), and ownership of data and privacy concerns should be addressed. This will help make it valuable to B2B partners.

5.7. Understanding the willingness to pay

The willingness to pay for each customer (B2C, B2B) has to be studied. In the projects that have included this in surveys, it was found that there is generally a certain willingness on the part of smallholders to pay for the proposed service. In some of these it was found, however, that smallholders – for numerous reasons – did not actually pay once the service was available. This means that understanding the willingness to pay not only requires a survey of smallholders, but also a broader understanding of the (potential) market and an assessment of existing similar tools that might compete with the services offered.

5.8. Retaining users

A successful and economically sustainable service benefits from a stable user base. This requires that the services provided are highly relevant throughout the year, and easy to use. In order to make them relevant throughout the year, features can be included that are also relevant outside of the growing season (e.g., market information, financial planning, health information). To reduce complexity for the user, the service should be designed together with farmers and have sufficient offline features (as there is often less connectivity than anticipated). In any case, frequent user satisfaction surveys are an important tool for understanding the degree to which the service is appreciated by all user segments and how it can be improved.

5.9. Planning for scaling of services

Scaling is required to generate sufficient revenue. Many of the G4AW partnerships are strongly focused on adding new products or moving to new countries. In many cases, scaling could be achieved more easily by strengthening the existing products in the country (market) where they are already active (higher market penetration). This, because the licences to operate, digital infrastructure, and extension network, are already available, reducing the costs to scale.

5.10. Accessing additional capital

Many partners see access to capital as the main limitation to continuing services. The problem is that more finance will not make the service sustainable if the basics are not covered. This means partners need to focus first and foremost on service optimisation, financial modelling, entrepreneurial competence building, and partnership brokering. An investor will not invest in a business if the business case is not solid and the business owner is not yet well established. Additional funding from public sources or grant programmes can help with de-risking the business case. It should be realised from the start of a project that in the long term, (private or own) financing is most likely required.

Colofon
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www.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