INNOVATION PACKAGING AND SCALING READINESS WORKSHOP REPORT

RWANDA-SMART NKUNGANIRE SYSTEM (SNS) FERTILIZER RECOMMENDATION TOOL - INNOVATION PACKAGING AND SCALING READINESS (IPSR) ANALYSIS FOR SMART AGRONOMY

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RAB RWANDA

Rwanda-Smart Nkunganire System (SNS) Fertilizer Recommendation Tool—Innovation Packaging and Scaling Readiness (IPSR) Analysis for Smart Agronomy

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Participants at the Innovation Packaging and Scaling Readiness Workshop.

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Executive summary

The SNS Fertilizer Recommendation Innovation Packaging and Scaling Readiness (IPSR) Workshop was held on 30 April 2024 in Kigali, Rwanda. The workshop aimed to identify challenges, bottlenecks and enabling elements for the Smart Nkunganire System (SNS) fertilizer recommendation tool (SNS-FRT), which provides tailored recommendations for six high-priority crops, benefiting over 1.5 million smallholder farmers in Rwanda. The event, facilitated by CGIAR and funded by Ukama Ustawi in collaboration with the Rwanda Agriculture and Animal Resources Development Board (RAB) and the CGIAR Excellence in Agronomy (EiA) initiative, brought together research, private and public institutions to discuss the system's readiness for scaling.

Scaling ambition

The scaling team will work together with RAB, BKTechouse, One Acre Fund (OAF), and farmer cooperatives such as the Imbaraga to accomplish the use of the fertilizer recommendation tool for an initial two of the six priority crops through the Smart Nkunganire System (SNS), supported by at least 10 sector agronomists, 200 farmer facilitators, and a total of 10,000 farmers in Rwanda contributing to the achievement the end-of-initiative outcomes for the Ukama Ustawi and EiA initiatives. Furthermore, 10,000 farmers will be selected for the pilot phase of the scaling using standardized scientific methods. The pilot phase will prepare the roll-out to over 1.5 million SNS-registered farmers. Thus, assuming a 20% adoption rate, at least 300,000 farmers will benefit from the fertilizer recommendation tool by 2025.

The IPSR workshop

The workshop included presentations, discussions, and collaborative ideation sessions focused on analyzing challenges and barriers to scaling SNS-FRT, Identifying and evaluating specific interventions to address these challenges and prioritizing the next steps for enhancing the SNS tool's effectiveness and user experience. Participants delved into topics related to innovation packaging, identifying enablers and solutions, and assessing innovation readiness and use. Through group work and collective discussions, the workshop participants developed a comprehensive understanding of the system's status and future needs.

Major challenges, barriers and bottlenecks

a. Limited user awareness of the system and limitations in technical navigation within the system.
b. Complexity in the SNS system is exacerbated by the number of steps (240 USSD steps to request fertilizer).
c. Accessibility of the system due to mobile network limitations causing timeouts.
d. The uncertainty in the long-term financial sustainability of the SNS system if the government pulls their support.
e. Delays in fertilizer supply to farmers from the time of ordering to the delivery within the entire fertilizer supply chain.

Key enablers/ packages

The workshop yielded several key insights and actionable recommendations:

a. Continuously update and validate the core innovation.
b. Awareness creation program to increase knowledge on SNS-FRT.
c. SNS-FRT improvement and implementation initiative.
d. SNS-FRT user feedback mechanism.
e. SNS-FRT compliance program for App users.
f. Inclusive business model for enhanced agricultural access.
g. Risk aggregator initiative for sustainable fertilizer financing.

Recommendations

Enhancing real-time decision-making capabilities and simplifying fraud control mechanisms to reduce complexity were identified as key steps in achieving successful scaling. In addition, the workshop noted that engaging with key stakeholders and exploring alternative approaches to improve farmer outreach to improve awareness of the tools and enhance use capacities and competencies among the farmers is a fundamental step to enhance user experience.

Acknowledgements

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List of Acronyms

BKTechouse: A technology company that develops digital solutions

CIP: International Potato Center

CGIAR: Consultative Group on International Agricultural Research

EiA: Excellence in Agronomy

ETG: Export Trading Group

FRT: Fertilizer Recommendation Tool

IITA: International Institute of Tropical Agriculture

ILRI: International Livestock Research Institute

IPSR: Innovation Packaging and Scaling Readiness

MEDA: Mennonite Economic Development Associates

MinAgri: Ministry of Agriculture

MVP: Minimum Viable Product

OAF: One Acre Fund

RAB: Rwanda Agriculture and Animal Resources Development Board

RICA: Rwanda Inspectorate Competition and Consumer Protection Authority

RISA: Rwanda Information Society Authority

RwaSIS: Rwanda Soil Information Service

SAnDMan: Smart Agronomy Data Management

SNS: Smart Nkunganire System

ToT: Training of Trainers

UNEP: United Nations Environment Programme

1 Introduction

1.1 Background

Rwanda's agricultural sector faces significant challenges, primarily due to limited land availability. Approximately 50% of rural households cultivate their crops on less than 0.35 hectares, and 85% on less than 1 hectare (MinAgri, 2018). This limitation is compounded by poor crop and nutrient management practices, resulting in yields that are far below their potential. To address these issues, the Government of Rwanda launched the Crop Intensification Programme in 2007, aimed at increasing the productivity of major crops through land-use consolidation, improved seed and fertilizer distribution, and farmer-to-farmer extension services. The introduction of the crop intensification program led to notable increases in the production levels of priority crops (MinAgri, 2018). In addition, the Strategic Plan for Agricultural Transformation emphasized the digitalization of Rwanda's agricultural extension services, resulting in various systems to improve Rwanda's agricultural sector (MinAgri, 2018). However, additional efforts were needed to further close yield gaps and enhance the sustainability of agriculture in Rwanda.

One of the critical components of the Crop Intensification Programme is the fertilizer subsidy scheme, which facilitates farmers' access to inorganic fertilizers within the "improved seed and fertilizer use component" (UNEP et al., 2016). However, this scheme currently relies on blanket fertilizer recommendations applied uniformly across the country, despite Rwanda's highly heterogeneous agro-ecological conditions. This one-size-fits-all approach results in inefficient use of expensive inputs, suboptimal fertilizer responses, and low-profit margins for farmers. Experiences from other countries suggest that site-specific fertilizer advisory services could potentially increase yields by at least 20%, while also reducing environmental risks through more efficient fertilizer use and maximizing returns on investment in the fertilizer subsidy scheme (Vanlauwe et al., 2023).

Between 2018 and 2021, CGIAR, in partnership with the Rwanda Agriculture and Animal Resources Development Board (RAB), developed and tested a pilot study of site-specific fertilizer recommendations for potato and cassava in selected agro-ecological zones. These efforts involved gathering data on fertilizer response variations through multi-location trials using the Smart Agronomy Data Management (SAnDMan) digital tool. Building on this work, RAB launched the Rwanda Soil Information System (RwaSIS) project, funded by the Bill & Melinda Gates Foundation, to develop a comprehensive digital soil information system. This initiative involved extensive fertilizer response trials for six priority crops (cassava, potato, rice, wheat, maize, and beans) over multiple cropping seasons, with data from these trials forming the basis for improved fertilizer recommendations.

Crop models and machine learning algorithms were calibrated to generate recommendations based on digital soil information and farmer-supplied input variables using the Excellence in Agronomy (EiA) AgWISE tools and algorithms (AgWise Development Team, 2023). Innovative validation approaches were also developed for on-farm conditions. As a result of the massive digitization drive by the Government of Rwanda, the digitization of the agro-input supply chain and subsidy scheme through the Smart Nkunganire System (SNS) in 2018, developed by BKTechouse and RAB, Rwanda now has a robust platform with over 1.5 million registered users. Therefore, the integration of advisory services such as the SNS-FRT into SNS is envisioned as a key strategy for delivering site-specific fertilizer recommendations to farmers at scale, thereby enhancing agricultural productivity and sustainability across the country.

1.2 The Innovation Packaging and Scaling Readiness (IPSR) workshop

This workshop motivated by the successful validation phase of the SNS-FRT in Rwanda for potato and rice. The workshop goal was to co-design a context-specific innovation package for the SNS-FRT to enable responsible scaling. The Innovation Packaging and Scaling Readiness (IPSR) workshop, under the CGIAR context, focuses on preparing agricultural innovations for broad adoption and impact by defining clear objectives. These include assessing the readiness of specific innovations for scaling; identifying key components; and developing effective dissemination and adoption strategies (Sartas et al., 2020). The IPSR workshop was held on 30 April in Kigali, Rwanda. The workshop focused on evaluating the innovation's readiness for scaling. This involved examining core elements like bottlenecks, enablers, partnerships, and institutional frameworks, thus assessing the SNS-FRT status and performance. Utilizing frameworks like the Scaling Readiness approach, the workshop assessed the maturity of SNS-FRT, identified gaps and barriers such as regulatory hurdles and market constraints, and equally identified enabling elements such as supportive policies and financial resources. Detailed strategies and action plans for scaling were suggested, focusing on capacity building, resource mobilization, stakeholder coordination, and monitoring and evaluation.

1.3 Key workshop objectives

- To assess the current performance of the SNS system where the fertilizer recommendations will be hosted.

- To identify and discuss the key bottlenecks faced by users and other key stakeholders in the fertilizer value chain.

- To propose practical solutions and enablers for improving the system.

- To enhance communication and coordination among stakeholders.

1.4 Workshop scope

The workshop addressed multiple dimensions of the SNS system, including technical aspects, user engagement, financial accessibility, and regulatory considerations.

1.5 Workshop participants

A diverse group of stakeholders participated in the workshop, including researchers, practitioners, policymakers, private sector partners, and community representatives (details in Annex 2). The workshop comprised 27 participants, with women making up 33% and men 67% of the attendees (see Table 1).

1.6 Summary of participants and Gender representation

Table 1: Summary of participants and Gender representation

Type of participant	Female	Male	Total
Participants	5	12	17
Facilitators and organizers	4	6	10
Total	***9***	***18***	***27***

To conclude the workshop, a roadmap for implementation was discussed. The roadmap outlines specific timelines, responsible parties, milestones, and success indicators, along with mechanisms for ongoing

monitoring and evaluation to track progress and make necessary adjustments. A plan to reconvene with the stakeholders who were present at this workshop is envisaged when a scaling strategy is drafted, tentatively in September 2024, to reevaluate the scaling readiness scores of the Rwanda SNS fertilizer recommendation tool.

2 Methodology

2.1 Identification of workshop participants

The selection of participants for the Rwanda SNS Fertilizer Recommendation Tool IPSR Workshop was a carefully structured process designed to ensure a diverse and comprehensive representation of stakeholders critical to the success of scaling agricultural innovations in Rwanda. The methodology involved identifying key organizations and individuals whose expertise, influence, and roles are pivotal in the agricultural sector. Criteria for selection included the organization's relevance to agricultural research, extension services, technology development, policy implementation, and direct engagement with farming communities. Each selected organization brought unique contributions to the innovation and scaling process, ensuring a holistic approach to workshop objectives (Table 2). By engaging these diverse organizations, the IPSR workshop ensured a comprehensive approach to innovation packaging and scaling, leveraging the unique strengths and expertise of each participant to achieve sustainable agricultural development in Rwanda.

2.1.1 Organizations and their roles

Table 2: Summary of organizations represented by the workshop participants, their roles, responsibilities and website contact

Organization	Role	Contact/ Website
1. Rwanda Agriculture and Animal Resources Development Board (RAB)	RAB is responsible for agricultural research and extension services in Rwanda. It focuses on improving crop and livestock productivity through research, innovation, and dissemination of best practices.	https://www.rab.gov.rw/
2. Rwanda Information Society Authority (RISA)	RISA oversees the development and coordination of information and communication technology (ICT) initiatives in Rwanda. It plays a crucial role in integrating ICT solutions in agriculture for data management, digital tools, and technology-driven innovations.	https://www.risa.gov.rw/
3. Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)	RICA ensures the quality and safety of agricultural products through regulatory oversight, inspections, and enforcement of standards. It supports scaling innovations by ensuring compliance with safety and quality standards.	https://www.rica.gov.rw/home
4. International Institute of Tropical Agriculture (IITA)	IITA emphasizes research to enhance agricultural productivity and sustainability in the tropics. It provides expertise in developing and scaling	https://www.iita.org/

	innovations in crop production, pest management, and agronomic practices.	
5. International Potato Center (CIP)	CIP specializes in the research and development of potato and sweet potato crops. It focuses on breeding, disease management, and improving nutritional value, contributing significantly to food security and income generation for farmers.	https://cipotato.org/
6. International Livestock Research Institute (ILRI)	ILRI focuses on livestock research to improve productivity and livelihoods. It works on developing and scaling innovations in livestock breeding, health, and sustainable livestock systems and leads the CGIAR Science of scaling**.**	https://www.ilri.org/
7. Imbaraga Farmers' Organization	Imbaraga is a farmer-led organization that advocates for farmers' rights and provides agricultural extension services. It plays a critical role in representing farmers' interests and facilitating the adoption of new technologies and practices.	https://www.imbaraga.org/
8. One Acre Fund (OAF)	OAF provides smallholder farmers with financing, training, and access to agricultural inputs. It supports scaling by helping farmers improve productivity and incomes through better farming techniques and resources.	https://oneacrefund.org/
9. BKTechouse	BK Techouse is a technology company that develops digital solutions for various sectors, including agriculture. It contributes to scaling innovations by providing technological tools and platforms that enhance agricultural productivity and efficiency. They have developed and hosted the current modules of the SNS in Rwanda.	https://bktechouse.rw/
10. Mennonite Economic Development Associates (MEDA)	MEDA focuses on creating business solutions that seek to address poverty. It supports agricultural value chains through investment, capacity building, and market access initiatives, facilitating the scaling of agricultural innovations.	https://www.meda.org/
11. ETG World	ETG World is a global agribusiness company that focuses on agricultural supply chains, providing inputs, logistics, and market access to farmers. It contributes to scaling innovations by supporting efficient supply chains and enhancing market linkages.	https://www.etgworld.com/

Media:	Media personnel play a crucial role in disseminating information, raising awareness, and promoting agricultural innovations. They help bridge the gap between research findings and practical applications by communicating success stories and best practices to a broader audience**.**	
12. TopAfrica News	TopAfrica News is a media outlet that focuses on reporting news and developments related to agriculture, environment, and sustainable development in Africa. It plays a role in raising awareness and disseminating information on agricultural innovations.	https://www.topafricanews.com/
13. Imvaho Nshya	Imvaho Nshya is one of Rwanda's leading newspapers, providing news coverage on various sectors, including agriculture. It helps in promoting agricultural innovations by reporting on success stories, challenges, and opportunities in the sector	https://imvahonshya.co.rw/

2.2 Workshop objective setting and initial assessment

The SNS-FRT IPSR workshop commenced with a session dedicated to defining clear objectives and providing background information on the development of the innovation, i.e., SNS-FRT. The technical and minimum viable product (MVP) development team presented the entire workflow and validation process and the integration of the site-specific recommendations for rice and Irish potato into the SNS. This presentation set the workshop tone for participants to collaboratively set specific goals, focusing on assessing the innovation readiness for scaling and identifying key components crucial for their success. The presentation characterized four key aspects that provided a basis for conducting the "scaling readiness" diagnosis: (i) the characteristics of the scaling intervention; (ii) what the intervention is trying to scale and why; (ii) the context in which the scaling intervention operates; and (iv) the stakeholders, their networks, and the other interventions in which they are involved. Conducting this step results in a clearly defined innovation package, consisting of core and complementary innovations where scaling is desired, in our case the whole country—Rwanda.

The declaration of the scaling ambition then followed this detailed presentation of the innovation development process. This led to the next stage, which involved the thorough evaluation of the status and performance of the SNS system and the fertilizer supply chain. This included an in-depth discussion of some previously identified challenges farmers face as they interact with the SNS system, effectiveness evaluations, and analyses of the capacity of the users. The workshop aimed to break down each innovation into its critical components.

2.3 Scaling ambition

The core innovation team provided an overview of the SNS fertilizer recommendation tool and the associated scaling ambition. The scaling team aims, by 2024, for CGIAR and partners to be working together with RAB, BKTechouse, One Acre Fund (OAF), and farmer cooperatives such as the Imbaraga to use the fertilizer recommendation tool for an initial two of the six priority crops through the Smart Nkunganire System (SNS).

Furthermore, the goal is for them to be supported by at least 10 sector agronomists, 200 farmer facilitators, and a total of 10,000 farmers in Rwanda, all contributing to the achievement of the end-of-initiative outcomes for the Ukama Ustawi and EiA initiatives. A total of 10,000 farmers will be selected for the piloting phase of the scaling using standardized scientific methods. The pilot phase will prepare the roll-out to over 1.5 million SNS-registered farmers. Thus, assuming a 20% adoption rate, at least 300,000 farmers will benefit from the fertilizer recommendation tool by 2025.

2.4 Innovation package design

2.4.1 Identifying challenges, barriers, bottlenecks and enablers

In this session, participants identified and diagnosed challenges likely to impede the stated scaling ambitions. Using flip charts posted on walls, experts who understood both the innovations and the scaling context were asked to categorize each identified bottleneck for compilation. These bottlenecks mentioned by the participants for each category are summarized in Table 3. Following the identification of key bottlenecks, workshop participants were divided into expert teams based on their backgrounds and envisaged role in scaling or influencing the adoption of the SNS-FRT. These teams then focused on crafting solutions and opportunities that addressed the mutually agreed-upon challenges from the previous session. Some of the solutions and packages developed include (i) an awareness creation program to increase farmer knowledge of the SNS fertilizer recommendation tool; (ii) support for refining the SNS system to improve the user experience; (iii) stakeholder engagement to identify sustainable business models for SNS, including data collection; and (iv) a risk aggregator initiative for sustainable fertilizer financing to evaluate fertilizer supply chain bottlenecks (e.g., delayed access) and provide recommendations. Table 3 summarizes the discussions addressed in the workshop, presenting the raw discussions as they were expressed by the participants.

Table 3 Key bottlenecks and enablers identified by workshop participants

S/N	Dimension	Bottleneck(s)	Solution(s)
0	Core innovation	1. The number of SNS steps (240 steps) makes it harder for farmers to often engage with the system resulting in late or no access to fertiliser in a season. 2. Internet and mobile network challenges limit access and use. 3. The Mobile Order Processing Application (MOPA) needs to be online to confirm sales, the network is not reliable, especially near the border towns. 4. The SNS system looks incomplete and not feasible for farmers to adopt more items, it is not upgraded often. 5. The system sustainability is not guaranteed because of the financing structure. 6. There are many delays in the disbursement of the fertilizer to the farmers because of the time effectiveness of the system.	**Main Solution for the core innovation: SNS fertiliser improvement initiative.** Reduce the step and make the system more user-friendly. Make the MOPA App to be lighter and if possible have it work offline. On the other hand, add lime and other micronutrient recommendations in the system. Then, improve the time of delivery and accessibility to the farmers. **Target**: Farmers, Agro-dealers and Suppliers (Agro Processessing Trust Corporation Ltd (APTC) **Who will work on this**: RAB and BK Techhouse **Sub-solutions** i. Continuously improve the system: to make it user-friendly, reducing the number of steps that users must take to get to the point of requesting fertilizer,

		7. The cost of having countrywide validation trials is high hence reconstructing and regularly updating the core innovation may be a challenge. 8. The SNS-FRT has the limitation of not integrating organic fertiliser, lime and other micro, macronutrients Mg, Ca, Mo. recommendations. 9. The contracting for lime is separate from NPK and the supply side is not fully organised.	ii. Have a smart phone option of the tool. Improve the registration and networking by making farmers register once a year not every season. iii. To cater for the network, we can recommend the use 2G network to make it lighter. Consider not having everyone in the system. This should be privately oriented and should be run by the private sector, however, it is not clear who will take up the cost if the system is privatised. We need sustainability beyond government involvement. Consider agro-dealers to take up the cost of running the SNS system. The system is substantially costly, you can also not give this data to the private sector. Have an App for farmers showing nearby dealers and the stock and allow them flexibility in their choice of agro-dealer to procure from. This is however tough to implement because of the subsidy and transparency mechanism to reduce fraud. Contracting for lime must be synchronised with that of NPK. Improve the supply side to be more organised. Contracts and tendering for lime need to be done and finalised long before the planting season. iv. For lime, this should be made an open market to improve availability. **Further discussions:** we can have a systematic user experience. One Acre Fund (OAF) has reports on the SNS user experience which can be used to improve the system.
1	Beneficiary/ user awareness of the core innovation	1.1 Registration in SNS does not mean farmers understand how the system works or how to manipulate the system's functionality. There is a lack of training and awareness in this regard. 1.2 There is a need for an end-user engagement. 1.3 There is a challenge in behaviour change because of the impact of traditional. agriculture (business as usual). 1.4 There is a lack of awareness and accessibility of SNS. 1.5 Farmers are challenged with the idea of change to adopt new technologies,	**Main Solution:** Awareness creation program to increase knowledge of the SNS fertilizer recommendation tool among farmers, extension agents and agro-dealers. The awareness creation program can include a baseline survey on current knowledge; demonstration trials at the village level; Training of Trainers (ToT) with RAB extension agents, sector agronomists, farmer facilitators and agrodealers; radio and TV talk shows (e.g. Tera Intambwe Muhinzi).

		1.6 There is a lack of clarity on the return on investment for farmers, farmers like practical practices that yield tangible results immediately.	
2	Beneficiary/ user confidence/ trust in the core innovation	2.1 Mindset change is a process that takes time for most farmers. 2.2 The age and gender of most farmers are a challenge as when the innovation is complex, the elderly cannot access it. 2.3 Adoption bottleneck: The bad experience from previous fertiliser recommendations that did not produce desired results increases resistance for farmers to accept the current fertilizer recommendation.	**Main Solution:** End user feedback approach to establish a two-way interaction between developers and end users through feedback loops (e.g. through SNS using USSD), a helpdesk (call) and scaling champions at the sector level. An end-user feedback approach must be established to support farmers who use fertilizer on the farm and to increase trust in the tool. **Target**: Farmers, Extension agents and agro-dealers.
3	Beneficiary/user access to the core innovation	3.1 Availability of inputs: SNS require farmers to register before agro-dealers can order. This leads to late adoption. 3.2 Difficulties in accessing SNS are common among the farmers in Rwanda as most farmers face challenges of network and capacity to register themselves but rely on the agro-dealer for the process. 3.3 The process of getting fertilizer is too long i.e., time taken from ordering to receiving the fertilizer. Hence some farmers receive fertilizer late into the season or growing period of the crop. 3.4 Lack of resources (Phones) to farmers. 3.5 There are three steps towards getting the fertilizer starting with the supplier, agro dealer then farmers. 3.6 The importation process takes around 4 months which is long. 3.7 Before you know the price that will be set it's difficult to know if the fertilizer will be profitable. 3.8 Stock thresholds: many agro-dealers will sell more than 1000 kgs per day and cannot get stocks above 1000 kgs. This also brings bottlenecks in transport (economies of scale). 3.9 The fraud and control dilemma: the more steps are meant to control fraud, but the more complex these systems are the higher the chance of fraud.	**Main Solution:** I. Make SNS seasonless to have fertilizer available all year. II. Farmers should not be tied to a single Agro Dealer. The farmers choose an agro dealer before they have an input and the agro dealer can not order before farmers register. Farmers do not take everything they register for hence leaving some fertilizer with the Agro-dealer. III. Agro-dealer orders should not be tied to registrations of farmers for inputs to reduce time lag for input availability(agro-dealer can use forecast demand) IV. Reduce 240 steps to avail inputs V. Stock thresholds can be removed VI. Policies around SNS should be improved VII. Agro Dealers should be able to transfer inputs between themselves VIII. Prices need to be negotiated earlier to allow for important timelines IX. Make the procedure as friendly as possible: Make the process easier. X. There is a need to modify the legislation to allow improvement in the efficiency of the process. XI. Have a coordination committee that can take decisions on the process to ensure there is no delay for the agro-dealers. The system is slowing down the agricultural development in Rwanda.

			XII. Thus, there is a need for real-time decision-making.
4	Beneficiary/user access to finances/ affordability of the innovation	4.1. In general, there are insufficient funds to purchase fertilizer which is relatively too expensive for farmers. 4.2. The price of agricultural inputs keeps increasing and going beyond the reach of many farmers. 4.3. Higher fertiliser costs upfront to meet a higher ratio even with a loan, farmers do not want to go into more debt	**Main solution:** A risk aggregator including government, impact funder, equity bank, and One Acre Fund, to hedge it with minimal capital and utilise impact development bank funders to provide the following solutions: i. Forward-looking contracting with larger buyers, contract with buyers who buy input of farmers agree to sell at market price plus a percentage. ii. The government can make agreements with Russia to lower the price. iii. Partially move to cash crops to enhance farmers' ability to pay for the fertiliser and the crops can be sold into international markets.
5	Beneficiary/ user compatibility with other innovation	5.1. Recommendation updates on soil analyses updates 5.2. Complexity of integrating the use of innovation into business	**Main solution:** The innovative business model, "Inclusive Access," addresses challenges in input and output markets by leveraging core innovations. It targets extension agents from both government and private organizations, including agro-dealers. This can be done with One Acre fund and we can learn from existing models
6	Beneficiary/ user capacity and know-how to appropriately use the innovation.	6.1. More steps are required to register and order subsidized inputs. 6.2 Lack of champions at farmers' level to register farmers into SNS and help them order subsidized inputs 6.3 More than 70% of farmers in Rwanda still need to be supported to use SNS in registering and/or ordering inputs.	**Main solution:** i. Reduce steps required to register and/or order inputs from 100+ steps to fewer than 25 steps. ii. Leverage the usage of TV sets at sector levels to show a video explaining how to use SNS. The video should be intentional and have a specific time and place to show to farmers. It should not just be a passive approach. iii. Identify and train youth as SNS training digital champions at the cell level and make them work performance-based. iv. At the agro-dealer level there is the boss, manager and the staff or technician in charge of selling the inputs directly to the farmer. **Therefore,** there is a need to target the right person i.e., the technician who directly advises the farmer in the shop.

7	Gender and social inclusion	No aspects were raised in group discussions. However, plenary discussions highlighted challenges for older women, particularly those without personal phones who rely on household devices. Literacy limitations further hinder their direct access to the SNS system.	
8	Legal conditions and governance required to add on	8.1. No compliance with regulatory requirements and standards especially on packaging of fertiliser and storage.	**Main Solution**: Integrated compliance procedure via packaging into sensitization or training on the use of SNS fertilizer recommendation tool. There is a need for policy and legislative improvements within the procurement and distribution process.
9	Stakeholder coordination and working partners	9.1 The Time for scaling is not yet clear but must align with the improvements suggested 9.2 No draft scaling strategies yet. 9.3 Less engagement from extension agents e.g. agronomists to farmers and the feedback is limited. 9.4 Timing of communication: changes in SNS are communicated when the season has started. Not enough time for feedback, understanding, and training. 9.5 SNS system will benefit BK Techhouse much more than other stakeholders.	**Main Solution:** Reinforce the two-way communication where the extension agents should timely report issues related to the system and inform of changes to the process. Continue to have communication related to challenges from the supplier (ATPC) to agro-dealers, government actors, research players and farmers.

2.5 Scaling readiness assessment

The participants were asked to score the core and complementary innovations for their innovation readiness and innovation use. They were asked to provide evidence that supports their assessment and score. The scoring demonstrated the overall "scaling readiness" of the innovation package and the core or complementary innovations that scored lowest and formed the key bottleneck to scaling the core innovation in Rwanda. This process facilitated strategic choices about (i) how to overcome the bottlenecks; (ii) which partners were to be involved; (iii) the most effective way to work with these partners; and (iv) the kinds of activities required to overcome the bottlenecks. Participants deliberated on the enabling solutions and complementary innovations, and developed a comprehensive summary of advanced tools and methodologies designed to enhance and support the effectiveness of SNS-FRT. This process emphasizes the integration of various innovative technologies and complementary approaches that work together to solve complex problems more efficiently. By combining these multiple innovations, the aim was to provide a holistic and synergistic effect, ensuring that each component enhances the functionality and impact of the others. This approach not only improves overall performance and outcomes but also facilitates the adoption and implementation of the SNS-FRT.

These discussions were summarized by evaluating the scaling readiness using standardized scaling readiness calculators (Table 4). These calculators support independent diagnosis of an innovation for its readiness and use. These are often used for assessing an individual innovation, or for assessing an innovation package consisting of innovations and other solutions and enablers (https://www.scalingreadiness.org/calculator/). Innovation

Readiness (IR) refers to the current demonstrated capacity of an innovation or enabling solution to fulfil its potential against a specific result. Readiness is measured across nine levels, ranging from low readiness where ideas are still being formed and tested, to high readiness where an innovation or solution is proven to work under real conditions (https://www.scalingreadiness.org/calculator/). On the other hand, Innovation Use (IU) is the extent to which an innovation or enabling condition is already being used or beneficial in society, and by whom. The table below summarizes the readiness and use scores for the SNS-FRT as assessed during the IPSR workshop.

Table 4 SNS Fertilizer recommendation tool Innovation Package Summary: Enabling Solutions and Complementary Innovations

#	Core Innovation/ Enabler	Short Title	Readiness and use scores	Description
1	Core innovations	Rwanda-Smart Nkunganire System (SNS) Fertilizer Recommendation Tool Readiness evidence: Use evidence:	**(IR-7, IU-3)**	
2	Enabler	Awareness creation program to increase knowledge of the SNS fertilizer recommendation tool Readiness evidence: Use evidence:	**(IR-0, IU-0)**	Awareness creation program to increase knowledge of the SNS fertilizer recommendation tool among farmers, extension agents and agro-dealers. The awareness creation program can include: a baseline survey on current knowledge; demonstration trials at the village level; Training of Trainers (ToT) with RAB extension agents, sector agronomists, farmer facilitators and agro-dealers; radio and TV talk shows (e.g. Tera Intambwe Muhinzi)
3	Enabler	SNS fertilizer recommendation tool improvement and implementation initiative Readiness evidence: Use evidence: Category: capacity and knowhow to appropriately use the core innovation	**(IR-2, IU-3)**	An improvement update designed to optimize the efficiency and accessibility of SNS fertilizer recommendations for farmers, agro-dealers, and suppliers. This initiative focuses on refining the user experience by streamlining the application process, making the tool more user-friendly with fewer steps, and enhancing its functionality for low bandwidth environments. Additional improvements include integrating lime and organic fertilizer recommendations, expanding options for fertilizer blending, supporting offline access, ensuring that all users can obtain crucial fertilizer information regardless of internet connectivity. Aimed at

				increasing the speed of delivery by agro vendors, this improvement initiative aims to provide a more robust and accessible platform, making precise fertilizer recommendations more readily available.
4	Enabler	SNS Fertiliser Recommendation Tool user feedback mechanism. Readiness evidence: Use evidence: Category: confidence and trust tin the core innovation	**(IR-0, IU-0)**	End-user feedback approach to establish a two-way interaction between developers and end users through feedback loops (e.g. through SNS using USSD), a helpdesk (call) and scaling champions at the sector level.
5	Enabler	SNS Fertilizer Recommendation Tool Compliance Program for App users. Readiness evidence: Use evidence: Category: legal conditions and governance required to scale the core innovation (bylaws, policies, regulations, and business models)	**(IR-0, IU-0)**	This program integrates compliance protocols directly into the training and sensitization sessions for the app. It is designed to enhance understanding and implementation of best practices in fertilizer usage. It ensures that users are well-informed about the regulatory requirements and the importance of adherence, promoting responsible and effective fertilizer application. This approach not only facilitates better compliance but also helps in achieving optimal agricultural outputs while maintaining soil health. The program targets all current and future users of the SNS tool, aiming to instil a culture of compliance that supports sustainable farming practices.
6	Enabler	Inclusive Business Model for Enhanced Agricultural Access Readiness evidence: Use evidence: Category: Compatibility of core innovation with existing farming/market/policy systems or business models	**(IR-0, IU-0)**	This model serves as a bridge connecting extension agents, both from private and government sectors, with agro dealers, facilitating access to SNS FRT. It focuses on integrating the entire agricultural value chain by providing essential resources and support to extension agents, enabling them to deliver more effective services to farmers. This approach ensures that all parties involved—especially those in remote or underserved areas—have improved access to the necessary tools and markets to optimize their agricultural practices.

7	Enabler	Risk Aggregator Initiative for Sustainable Fertilizer Financing Readiness evidence: Use evidence:	**(IR-0, IU-0)**	The initiative is designed to enhance fertilizer affordability and stabilize prices for farmers. It features subsidized financing options and a price stabilization initiative (e.g. fund, negotiate with source countries etc.) to mitigate cost fluctuations. Flexible loan structures tailored to the agricultural cycle to allow for manageable repayments aligned with harvests. The Initiative also facilitates bulk purchase agreements to leverage collective buying power, reducing fertilizer costs. Additionally, it incorporates risk-sharing mechanisms among stakeholders and real-time price monitoring to provide farmers with timely market insights. This comprehensive approach helps farmers access necessary inputs affordably.

3 Next steps

Key research questions to guide the data collection and analysis of the progress of the enablers were drafted to identify and quantify the process below:

Is the system usable and how might we make it easier to use?

1. User experience evaluation (Partners: CGIAR, OAF, BKTechouse, RAB)

- Collate existing information: gather existing user experience (UX) data from OAF and other partners. This will identify any gaps in understanding user needs, which we can then prioritize for further research.

- Sessions with RAB, OAF and BKTechouse to discuss and resolve bottlenecks, focusing on both immediate fixes and long-term improvements.

- Engage system users in prototype testing and collect quantitative feedback to measure and improve user experience.

- Conduct assessments with RAB staff and key farmers in rice and potato districts to gain insights into the user experience and identify areas for enhancement.

- Communicate with BKTechouse around the required technical adjustments and to brainstorm potential system enhancements.

Can the farmers afford the solution and how might we ensure they can in a sustainable way?

2. Innovation affordability and financial analysis (Partners: CGIAR, OAF, BKTechouse, RAB)

- Compile data on the affordability of SNS and the potential impact on stakeholders.

- Perform comprehensive financial assessments to evaluate the feasibility and return on investment.

- Investigate funding sources and public-private partnerships to support the implementation of the SNS and the fertilizer recommendation tool.

- Organize collaborative sessions with partners to review the financial analysis and align strategic priorities for innovation affordability.

How does the market currently deliver the inputs and what improvements are needed to ensure farmers have what they need at the right time?

3. Fertilizer business process and service design analysis (Partners: CGIAR, OAF, RAB, Fertilizer companies and agro-dealers)

- Conduct an in-depth review of the fertilizer and other input supply chains in Rwanda, focusing on operations and efficiency.

- Collaborate with key partners including the APTC to identify critical challenges and obstacles within the supply chain that impact performance.

- Develop and recommend strategic solutions and process improvements to address identified bottlenecks.

How will the intended users become aware of the solution, learn to use it, and integrate appropriate GAP?

4: Awareness and capacity building (Partners: CGIAR, OAF, BKTechouse, RAB)

- Investigate the first introduction of the SNS to Rwandan farmers and gather insights on adoption challenges and successes.

- Understand how BKTechouse communicates new system updates and identify opportunities for improvement.

- Develop targeted training programs to address knowledge gaps and support farmers and extension agents effectively using the SNS system.

- Establish channels for timely feedback between extension agents and the technical team, ensuring issues and process changes are reported and addressed efficiently.

What will a successful scaling strategy look like?

5. Development of a human-centred scaling strategy

- Review the identified gathered information from questions 1–4 to determine the scalability potential and identify successful elements that could be expanded.

- Pinpoint opportunities for scaling innovations, services, and best practices based on user experience, market analysis, and capacity-building feedback.

- Develop a clear framework outlining the criteria for scaling, including resources, infrastructure, partnerships, and potential challenges.

- Collaboratively refine the scaling strategy and gather support from all the partners.

- Communicate the strategy.

4 Conclusions

The SNS Fertilizer IPSR Workshop was a valuable platform for discussing the challenges and opportunities associated with the SNS system. By addressing the identified bottlenecks and implementing the proposed solutions, the system's effectiveness and user satisfaction can be significantly improved. On-going engagement

and feedback from all stakeholders will be crucial for continuous improvement. The workshop concluded that, while the core innovation is at early readiness and use levels, there is significant potential for improvement. The SNS tool's core innovation rating is promising, and further pilot testing is expected to enhance its effectiveness. The scaling team was encouraged to remain focused and vigorous on overcoming hurdles and integrating with governmental efforts to achieve rapid scaling. Stakeholders were urged to address policy and procedural bottlenecks to improve the system's utilization and support agricultural development in Rwanda. Therefore, by continuing to address these challenges and leveraging collaborative efforts, the SNS fertilizer recommendation tool can become a more robust and widely adopted resource for Rwandan farmers.

5 Event media coverage

1. https://www.topafricanews.com/2024/05/04/the-rwanda-sns-innovation-expansion-tailored-fertilizer-recommendations-for-smart-and-sustainable-farming/
2. https://imvahonshya.co.rw/impuguke-nabafatanyabikorwa-barashakisha-uko-hahangwa-udushya-mu-kunoza-smart-nkunganire-system/
3. https://twitter.com/CipotatoRW/status/1787462787356045762
4. https://twitter.com/CipotatoRW/status/1787462811825676446
5. https://twitter.com/CipotatoRW/status/1787462836928549201
6. https://www.cgiar.org/news-events/news/meet-this-years-winners-of-cgiars-scaling-fund/
7. https://www.linkedin.com/posts/cgiar-excellence-in-agronomy-initiative_agronomy-agronomy4adaptation-usecase-activity-7206264091974262786-gu3E?utm_source=share&utm_medium=member_desktop

6 Annexure

Annex 1. Agenda

Time	Topics (WHAT?)	Outcome (WHY?)	Type of session (HOW?)
9.00am	Welcome remarks, ice breaker, introductions and hopes	Participants arrival and registration at the venue, they get grounded in the topic and expectations, and they have shared their personal hopes for the day	Plenary discussion and exercises
9.40am	Innovation description and scaling ambition	Everyone is reminded about the innovation that is being scrutinized, as well as on the related scaling ambition	Plenary presentation and discussion
10.30am		***Break***	
10.50am	Innovation packaging: barriers, problems, and challenges	The group has done a thorough analysis of the challenges and problems that prevent scaling of the innovation	Individual reflection and (plenary) collective sense-making
11.55am	Innovation packaging: enablers, solutions, and opportunities	Participants have suggested concrete and specific interventions (complementary innovations and enablers) to address the challenges	Breakout group work
12.30pm		***Lunch break***	
1.30pm	Innovation packaging: taking stock of enablers	The group has taken stock of and critically reviewed all the enablers / solutions suggested	Plenary sense-making
2.10pm	Innovation readiness assessment	Everyone is clear on what is an innovation readiness assessment and they have assessed the readiness of their suggested enablers / solutions	Plenary presentation and breakout group work
2.45pm	Innovation use assessment	Everyone is clear on what is an innovation use assessment and they have assessed the use of their suggested enablers / solutions	Plenary presentation and breakout group work
3.20pm		***Break***	
3.35pm	Innovation scaling readiness - Taking stock	The group has taken stock of the emerging whole innovation package; They have made initial sense about priority next steps	Breakout and plenary group sense-making
4.10pm	Coming full cycle, next steps and closing	Everyone has reflected on the workshop; they are clear on next steps	Individual reflection and plenary discussion
4.30pm		**Closing**	

Annex 2: Workshop logistics summary

Name of Demand Partner	Rwanda Agriculture and Animal Resources Development Board (RAB)
Workshop Title	Rwanda Smart Nkunganire System (SNS) fertilizer recommendation tool-Innovation Packaging and Scaling Readiness (IPSR) for smart Agronomy
Venue	M-Hotel, Kigali Rwanda
Date	30 April 2024
Workshop Topics	3 Overview of the Rwanda SNS-fertilizers recommendation tool. 4 Innovation description and scaling ambition 5 Innovation packaging: barriers, problems and challenges 6 Innovation packaging: enablers, solutions and opportunities 7 Innovation packaging: taking stock of enablers 8 Innovation readiness assessment 9 Innovation use assessment 10 Innovation scaling readiness - Taking stock 11 Coming full cycle, next steps and closing
Approach and Training materials used	Used the standardized CGIAR IPSR workshop format through PowerPoint presentations, group and participant's discussion, flipcharts, and other materials
Funding projects and percentage	CGIAR Ukama Ustawi and Excellence in Agronomy Initiatives
Facilitators of the Training (Name and contact information)	Edwin Kangethe: e.kangethe@cgiar.org Thompson Ogunsamni: t.ogunsanmi@cgiar.org Esther Kihoro: e.kihoro@cgiar.org

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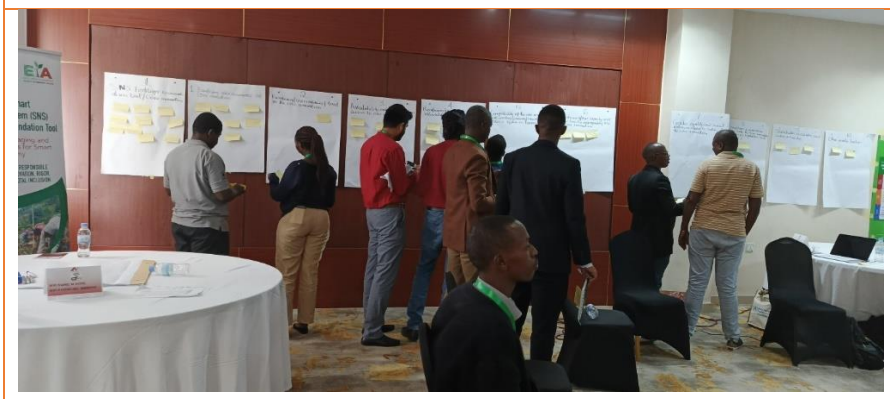
Annex 4 Workshop pictures

Group photo taken at the end of the workshop. *Photo credit: CIP*

Presentation of the core innovation in the workshop. *Photo credit: CIP*



Identification of the bottlenecks to the adoption of the new fertilizer recommendation tool & assessment of the proposed solutions. *Photo credit: CIP*

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