FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative

SENEGAL Naatal Mbay

Cereal Value Chains

DATA-DRIVEN AGRICULTURE

Farmers are aware of the power of information. However, few of them have accurate data on their agricultural activities or tools to allow them to make use of the data they do have. By adopting digital information systems, producer networks are able to manage their activities, determine their input needs, develop partnerships, and reinforce their professionalism.

2019

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INTRODUCTION

The integration of small farmers into competitive and profitable value chains rests on a capacity to manage information flows. Feed the Future recognizes that today's digital information and communication technologies have the power to transform a multitude of isolated farms into consolidated production units numbering thousands of hectares, giving way to significant economies of scale.

Through its Senegal Naatal Mbay project, Feed the Future trusts that the self-organization capacity of small producers and local Micro, Small and Medium Enterprises (MSME) can lead to the construction of robust self-managed digital solutions adapted to their management needs and compatible with their technological context and education levels. The objective of Feed the Future has been to lay the foundations of a new business ecosystem where producer organizations own their data and steer their own growth and development in a resilient way.

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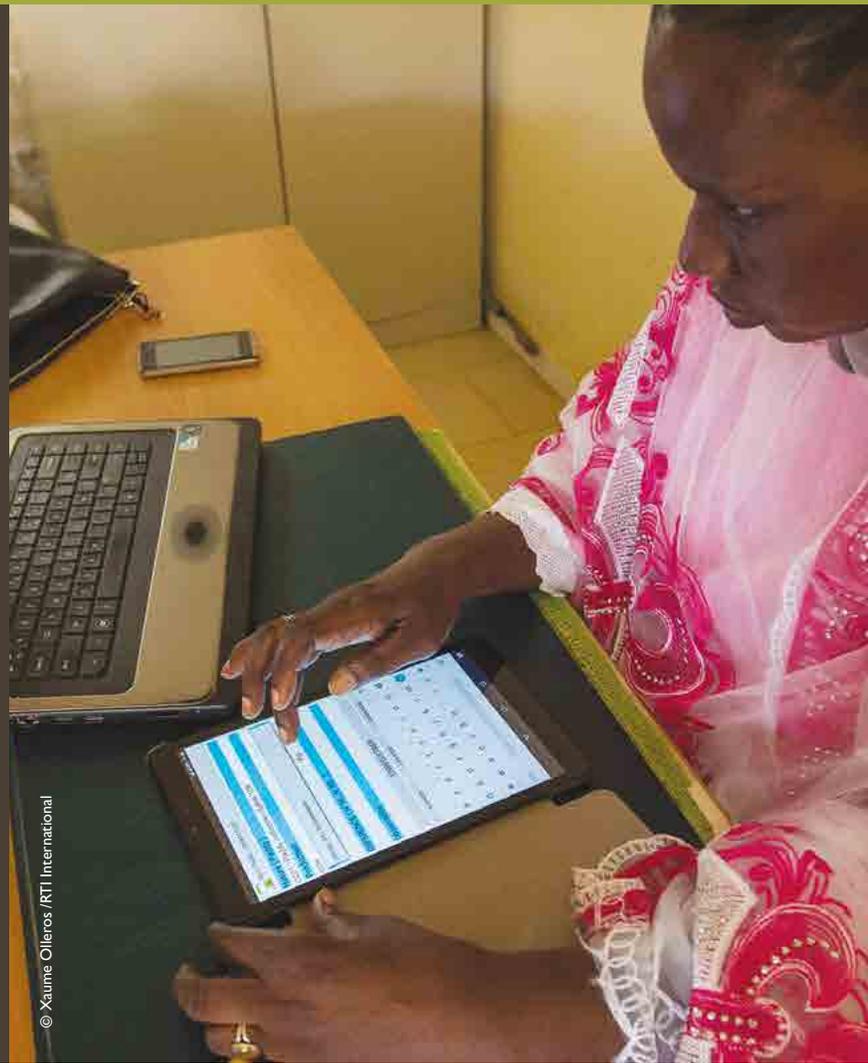
BACKGROUND

In Senegal, the majority of farmers do not have a system to monitor their crop production activities. Generally, producers do not have the tools to effectively manage their inputs, monitor and evaluate their own performance, learn from their experience, and strengthen their credibility with value chain support organizations such as financial institutions and technical partners.

Agricultural support is typically provided through state-run extension services, and technical agencies that control data collection and analysis. In this context, producers depend on others to access the data required for planning and carrying out their activities effectively. In the cereals sector, only a few producer networks working with industrial scale manufacturers in the Senegal River Valley documented, in a limited manner,

their operations relating to credit, input supply, marketing, and follow-up on membership.

The development of easy-to-use information technologies, the accessibility to computer equipment, the improvement in connectivity in rural areas, and the exposure of producers to these technologies have ushered in a wider use of decentralized information management at the producer level. However, even with this new digital landscape, the solutions typically implemented by development partners continued to rely on external data management providers.

Exchange Rate : Financial data originally presented in this note has been converted at the standard project exchange rate of US$ 1.00 = 500 FCFA.

TECHNOLOGY DESCRIPTION

The Naatal Mbay project has developed a data management system underpinned by the principle of producer accountability, which redefines traditional approaches to monitoring and evaluating agricultural activities. This "open-architecture" system helps empower producers by providing them with useful information for decision-making. Consequently, it transfers the responsibility and ownership of data collection, analysis, and sharing to the first beneficiaries of this technology, namely, producer organizations, agricultural enterprises, NGOs, and other stakeholders whose goal is improved rural development.
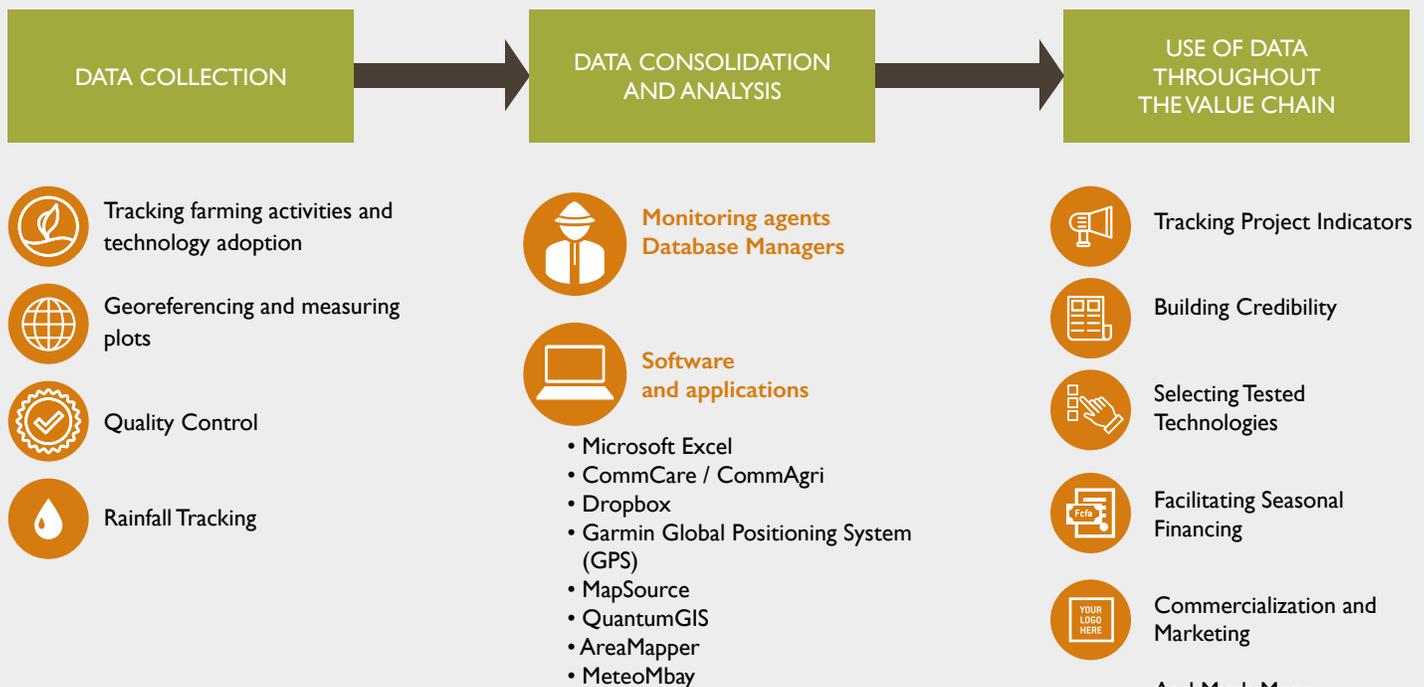
By "open architecture" we mean that the system is assembled using basic technology tools; they are easily accessed by users and their features go beyond the strict project monitoring boundaries. Consequently, the producer benefits from a substantial economy of scale that provides access to stable, sustainable, and cheaper digital applications and software that are not dependent on a project.

The system is managed by network teams that include one or more database managers and leading community facilitators and producers. Three major types of information are collected : i) composition of the groups (list of producers and their identity, location of their plots of land, membership organization, gender, contacts, etc., ii) seasonal production planning (pr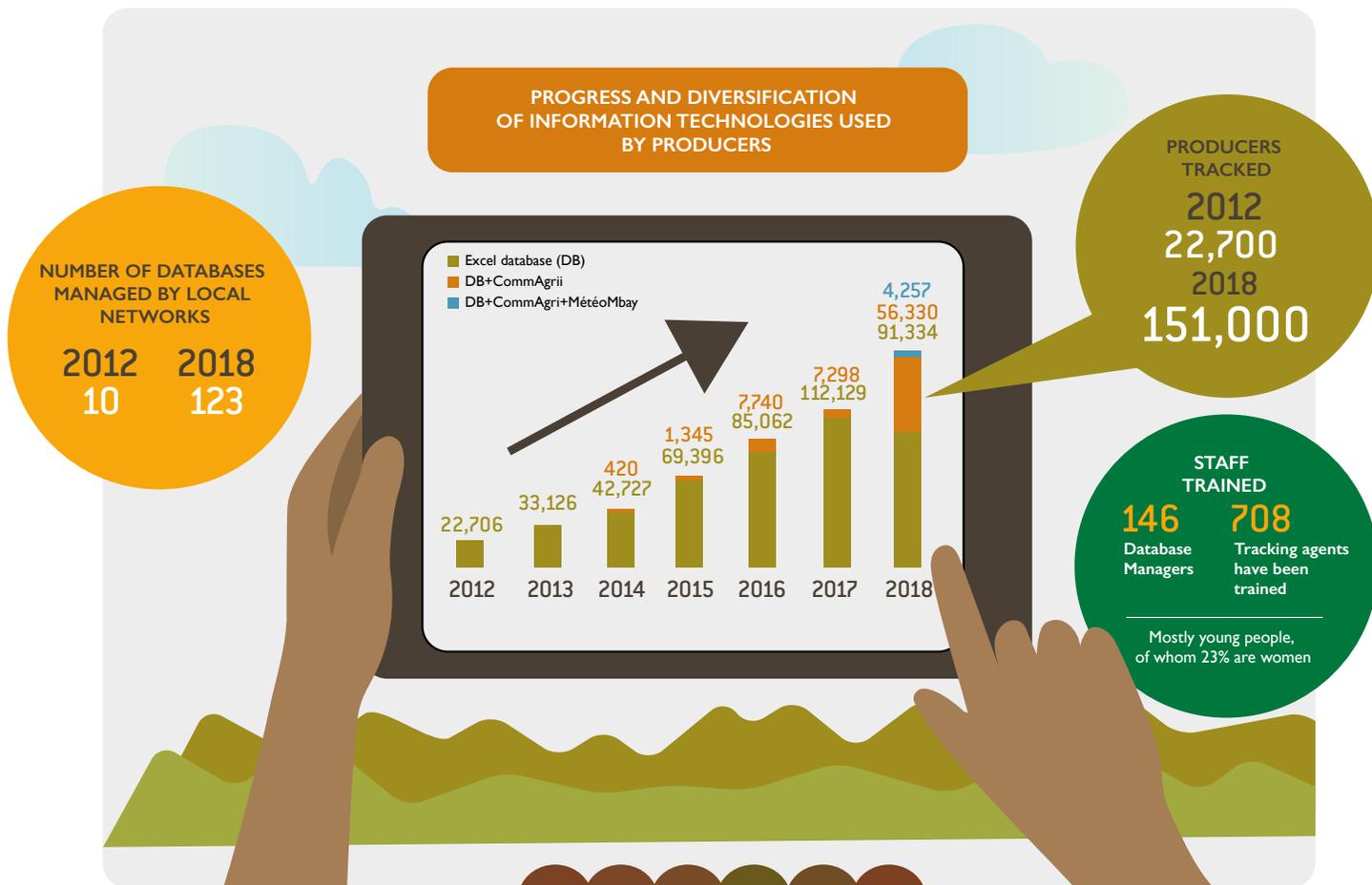e-season input needs, tracking dates of various agricultural operations, quantities of inputs used, etc.; and iii) agronomic monitoring of plots (identification of the plots, georeferenced data to determine the cultivated area, list of different technologies used on the plots, evaluation of yields, etc.). Some organizations also collect data on rainfall and production quality controls.

The basic equipment starts with laptop computers installed with simple and accessible software applications such as Microsoft Office, Dropbox, and mapping software (Mapsource and Quantum GIS). Mobile phones (smartphones) have also been made available to the networks with access to applications such as MétéoMbay and CommAgri (based on the open-source platform CommCare by Dimagi) which are used respectively for monitoring and sharing climate information and for agronomic monitoring of plots of land. The choice of these easily accessible and technologically stable digital tools and their gradual implementation by producers have been key factors in the success of this innovation.

AN ACCESSIBLE AND EFFICIENT DATA COLLECTION, ANALYSIS, AND SHARING SYSTEM

DATA COLLECTION	DATA CONSOLIDATION AND ANALYSIS	USE OF DATA THROUGHOUT THE VALUE CHAIN

DATA COLLECTION
- Tracking farming activities and technology adoption
- Georeferencing and measuring plots
- Quality Control
- Rainfall Tracking

DATA CONSOLIDATION AND ANALYSIS

Monitoring agents
Database Managers

Software
and applications
- Microsoft Excel
- CommCare / CommAgri
- Dropbox
- Garmin Global Positioning System (GPS)
- MapSource
- QuantumGIS
- AreaMapper
- MeteoMbay

USE OF DATA THROUGHOUT THE VALUE CHAIN
- Tracking Project Indicators
- Building Credibility
- Selecting Tested Technologies
- Facilitating Seasonal Financing
- Commercialization and Marketing

And Much More…

RESULTING CHANGES

NUMBER OF DATABASES MANAGED BY LOCAL NETWORKS

2012	2018
10	123

PROGRESS AND DIVERSIFICATION OF INFORMATION TECHNOLOGIES USED BY PRODUCERS

- Excel database (DB)
- DB+CommAgrii
- DB+CommAgri+MétéoMbay

	2012	2013	2014	2015	2016	2017	2018
	22,706	33,126	420 / 42,727	1,345 / 69,396	7,740 / 85,062	7,298 / 112,129	4,257 / 56,330 / 91,334

PRODUCERS TRACKED

2012	22,700
2018	151,000

STAFF TRAINED

146 Database Managers

708 Tracking agents have been trained

Mostly young people, of whom 23% are women

The digitization of activities has affected how producer networks conduct their farming activities in several ways. Data-driven agriculture has created new performance benchmarks for producers. The accuracy of statistics and forecasts enhances collaboration with the other stakeholders in the value chain and institutional environment. It creates trust. Driven for the most part by young people, these systems have a transformative effect on the group's internal organization.

Producers are empowered by being at the center of their own decision-making

Networks now have at their disposal the relevant data that concerns them and they are in a position to analyze this data to support monitoring and evaluation activities of network performance, plan seasonal input needs, support loan applications, make harvesting forecasts, monitor quality control, and organize marketing.

Databases contribute to the efficiency of the producer organizations and support structures

The databases and Information Technology (IT) packages made available to the stakeholders have allowed producer organizations to keep a comprehensive list of members with relevant demographic information (age, sex, etc.), as well as plot information (plot size, crops planted, etc.). This data also allows organizations to better manage their organizational structuring, map out key focus areas, and visualize the spatial distribution of the associated populations. For the Kaolack Seed and Grain Company (KASEC), for example, the database implemented with project support has made it possible to determine the geographic coverage of the seeds that it distributes throughout the region.

Producer networks have accurate information to determine the input and financing needs of their members

Producer networks provide their members with many services including facilitating access to inputs (seeds and fertilizers) through group purchasing. Networks therefore need key information on areas to be cultivated and the selected seed varieties to correctly calculate the combined input requirements. Connected to inputs, the databases also allow networks to properly document loan applications and negotiate more advantageous terms with financial institutions. Geographic location data also facilitates logistics planning for input distribution.

Networks estimate yields and productivity before harvest to plan marketing arrangements in a timely manner

With the help of georeferencing technologies, producers have accurate information on the size of their plots and the areas cultivated. Training received on good agricultural practices, together with knowledge of the yield potential for various seeds, provides important decision-making information. Using these tools and knowledge, producers can prepare for and negotiate marketing activities well in advance.

Partners now view producer networks as credible entities

With the information generated from databases, producers can develop solid and precise negotiating positions. Negotiating using verifiable data reinforces their image and credibility among value chain partners and strengthens their ability to interact with key partners such as banks, insurers, industrial mills, etc.

Information is secure and easily accessible

Increased digitization has made it possible to store data on multiple family farms in a more accessible and secure way -- initially collected in Excel databases, then stored on the Internet using Dropbox. Networks are no longer at risk of losing data if data collection books get wet, torn or lost, knowing that it is available on the cloud.

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The CommAgri application uses the internationally recognized CommCare Cloud-based platform, operated since 2011 by social enterprise Dimagi.

COMMAGRI, AN APPLICATION FOR PRODUCER NETWORKS

CommAgri is the result of collaboration between Feed the Future and the CommCare open-source platform developed by Dimagi (www. dimagi.com). This mobile application, originally developed for the health sector, has been adapted in Senegal for cereal value chains. CommAgri enables:

- Producer management (geographic and demographic identification and expression of needs);
- Field monitoring and production (training, agronomic monitoring, crop calculation, yield calculation, quality control);
- Credit monitoring and reimbursement (producer credit and reimbursement and reimbursement of suppliers and the bank);
- Production and processing (receipt of raw cereals, processing, packaging);
- Inventory management (movement in/out of inputs, reimbursement by producers, reimbursement to the bank, processed products);
- Sales management (identification and management of customers, orders, delivery, billing).

Deployment of the application within the framework of the Feed the Future Senegal's Naatal Mbay project has been a gradual process that adapted to producer needs and demands over time. In 2014, the application was first deployed with one producer network managing its producer and plot information. Then, from 2016 to 2017, two applications were deployed with 19 networks. The first "CommAgri Light" version incorporated producer and plot management with agronomic monitoring and credit monitoring. The second application, "CommAgri Standard," included the same features as the light version and added the ability to calculate plot sizes and manage inventory. The standard version costs an organization approximately US$ 60 /month, while the lite version is available free of charge. In the test phase, producers preferred the light version over the paid version. In 2018, the application was deployed with 56 networks, incorporating 60,587 grain producers in northern and southern Senegal.

FACILITATION APPROACH

The process began with a participatory assessment of the information needs of partner producer networks focusing on performance indicator monitoring and annual planning. This assessment also included a review of the different roles, responsibilities, and skills of the players involved, as well as the physical and organizational characteristics of the technical and human resources required for data collection. The main actions to validate and launch the system included :

1. Stakeholder Awareness-Raising
Most producer networks were learning to manage a data system for the first time. Many members did not know what a laptop was, let alone an Excel spreadsheet. Raising awareness of the usefulness and importance of data monitoring was a critical step in implementation of the system.

2. Identifying, Developing, and Validating Appropriate Tools
Database models and the various collection tools were developed by Feed the Future Senegal projects (Economic Growth Project and Nataal Mbay) according to the information needs of partner networks. Tools were then tested in various target value chains and adjusted according to the feedback from partner organizations.

3. Distribution of Equipment and Software
A starter kit of basic equipment was provided to partners to support the data collection and processing. This kit included a GPS device and a laptop equipped with Microsoft Office. Database managers and some pilot farmers operate laptops and solar charged computers make it possible to work in rural areas without electricity. For networks using this portable equipment, data could be entered directly into the database at collection sites. After one or two seasons, the more advanced groups were introduced to a smartphone enabled version of their system with the "frontline" data collection application (CommAgri) that allows data collection to take place offline and accelerates data entry, reduces entry errors, and speeds transmission over the Internet once connected.

4. Capacity Building
Training sessions were organized for network facilitators and database managers on the use of data collection tools, GPS, and mapping software such as Mapsource and Quantum GIS, and MS-Excel spreadsheets. The networks also received user guides and relevant training manuals. As part of the iterative implementation process, additional training was held before each planting season to share and validate tools, methods, and database models. Database managers were trained and assisted in developing an analysis plan that describes the reporting structure and indicates the types of data required for each component according to the project partnership agreement.

5. Monitoring and Evaluation of the Data Management System
The process of developing and refining data management tools continued throughout project implementation. Adjustments were made each year based on evaluations carried out systematically at the end of each season, so that new information needs of the partner networks and the project were incorporated. The project team tracked the need for technology enhancements and proposed additional tools to be developed. Data quality assessments were conducted annually.

INTRODUCING PRODUCER NETWORK TO DIGITAL TECHNOLOGIES
An evolving process fto reinforce and diversify their technology options.

PHASE 1 – Creating Profiles
The standalone use of basic technologies (spreadsheets, GPS coordinates) through the creation of simple databases: identification and listing of members according to gender, declared plot size, varieties sown, fertilizer needs, participation in credit, insurance, or training activities.

PHASE 2 – Conducting Analysis
The next phase is the standalone measurement of key performance parameters: sowing date, sowing density fertilizer application, harvesting dates, precise surface area under cultivation, and local rainfall. The declared plot areas are tested using GPS and yields are determined in accordance with standard statistical methods. For each season, local managers use advanced spreadsheet functions to evaluate performance and discuss findings at the local level with producers.

PHASE 3 – Using Information
The transition to "Cloud" technologies to manage network data and support day-to-day member decisions: loan and insurance applications, orders and deliveries of inputs, daily rainfall, harvesting services, etc. are added to the databases.

CROSS-SECTORAL PHASE – PROMOTING INTERACTIVITY
Throughout the process, databases provide information on interactions with regional rural authorities, their supplier partners and clients, as well as the financial institutions.

INTRODUCING NETWORK PRODUCERS
TO DIGITAL TECHNOLOGIES

PHASE 1:
PROFILING

- Definition of data needs
- Basic training for Excel
- List of farmers
- Recording of GPS coordinates in the field
- Production of the first series of data

DATABASE

PHASE 2 :
ANALYSIS

- Management of input supply
- Evaluation of yields
- Monitoring of training
- Production of topographical maps
- Harvesting forecasts
- Data capture of rainfall

SEASONAL DATA

PHASE 3 :
USE OF INFORMATION

- Monitoring of production
- Forecasting yields
- Quality control and monitoring
- Training
- Data monitoring at village level
- Production of inexpensive videos

TRANSACTIONAL DATA

INTERACTION

- Government
- Banks
- Buyers
- Suppliers

PARTNERSHIPS AND SYNERGIES

Through its successive projects, the Economic Growth Project (PCE) and Naatal Mbay, Feed the Future has played a pioneering role in helping grassroots organizations take ownership of information technologies. A guiding principle of the program, however, was to avoid creating a dependence on the project to maintain these technologies. Thus, apart from access to generic IT applications, Feed the Future has helped networks establish links with open-source technology providers such as Dimagi. CommAgri applications developed with the support of Feed the Future will thus become accessible to all rural stakeholders beyond the life of the project.

In addition, producer organization databases have made it possible to strengthen relationships with financial institutions such as banks and insurance companies. The association of technology with access to inputs, credit, and protection against climate risks encourages producers to pay for technology services themselves.

For their part, financial institutions see the producer organizations' newly acquired data skills as an opportunity to decentralize their networks by spreading digital finance to rural areas.
Finally, the reliable statistics generated by producer organizations are attracting the interest of development partners active in related initiatives. Several have already taken advantage of the services offered by the database managers for monitoring other programs in their areas.

In 2018, a digital gateway between the producer organization databases and Ministry of Agriculture and Rural Equipment regional and departmental services was developed with the support of Naatal Mbay.

This dynamic of synergy and integration will be amplified by professional organizations managing these producer networks, which are now on the cutting edge of digital services for rural populations.

Training session for Ministry of Agriculture decentralized staff and farmer network database managers on the data exchange platform developed by Senegalese company Daris Consulting. This digital statistics exchange platform between the producer networks and the Regional Rural Development Divisions was created with the support of Feed the Future. The platform provides detailed network data on hectarage, seed varieties and yields, as well as local rainfall, and contributes to the statistics of the Ministry's monitoring and evaluation programs.

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ACHIEVEMENTS

Since the launch in 2012 with an initial group of ten organizations, the number of databases managed by local networks had increased to 123 in 2018. They have generated a wealth of agronomic and economic data, evidence-based practical knowledge, and good agricultural practices for information management. With 146 database managers and 708 trained monitoring agents (mostly young people, of whom 23 percent are women), rural areas now have a pool of skilled people ready to accelerate the digitization of the agriculture sector.

Beyond these achievements, a new approach to digital technologies promoted by Feed the Future has been explored and validated.

Identification of Appropriate Technologies

The gradual implementation of contextually appropriate digital tools for rural users is the cornerstone of a digital integration experience. This entails selecting "simple and robust" technologies that do not require highly trained and qualified users. The adaptation of data collection tools to the needs and skills of users is a key factor contributing to the adoption of the innovations proposed. A key takeaway is that producers can find within their communities human resources that are able to manage a range of simple to complex systems.

Producers Developed an Entrepreneurial Culture

Empowering producers with their own databases fosters an entrepreneurial culture that translates into better internal organization, the ability to anticipate needs, plan for them, and take stock of their actions. All of which increases their credibility among technical and financial partners.

Rainfall Monitoring for Rainfed Agriculture

Technologies to monitor rainfall for agriculture are extremely useful tools for enhancing the resilience of producers faced with climate change. They now rely on precise and reliable data to decide when to plant their cereal crops each season or to select the seed varieties and inputs best suited to changing climate patterns.

Taking Gender into Account

Monitoring women's participation, their access to inputs and land, and their yields has proven to be a powerful advocacy tool for the empowerment and inclusion of women in the support activities. Gender-specific data is examined in debriefing sessions with farmers who discuss differences in yield profiles to learn from them, discuss and agree on possible adjustments to promote greater gender inclusion.

TESTIMONY

M. BACARY MANDIANG,
Coordinator of the African Association for Agricultural and Cultural Youth (AAJAC) / Committee for the Fight to End Hunger (COLUFIFA)

The information system is the central tool which has helped us to make our data available and to capitalize on our experience, helping with decision-making in real time. It is generally accepted that good decisions are based on quality data, so the database remains for us an excellent tool that the organization has ended up adopting; it is mandatory that all managers in each of our operational areas maintain it. It is also used in advocacy and fundraising. This excellent tool will undoubtedly allow us to continually improve our performance.

CHALLENGES

Integration of Databases into Value Chain Governance
In the long term, more support is needed for effective integration of network databases into the value chain governance system as well as comprehensive use and in-depth data analysis. In the future, it will be important to further involve local and national institutions in the process to realize wider impact and promote sustainability.

Self-Financing of Costs
The value of this data, currently recognized by producers and their partners, makes it possible to be optimistic about the sustainability of the system. However, managing the design and training costs of expanding the applications of these databases will require collaboration between producers and their partners, who for the most part use the data or benefit from its use. Partnerships with banks, insurance companies, input suppliers, and the Government must be established and strengthened.

Data Security Management
Database managers are subject to security obligations. They must be made aware and trained in order to be able to take the necessary measures to guarantee the safety of the data collected and avoid their disclosure to unauthorized third parties. Most of the data collected is linked to personal information and in 2008, Senegal passed a personal data protection act which seeks to protect personal data as much as possible.

TESTIMONY

M. IBRAHIMA HATHIE,
Research Director, Agricultural and Rural Prospective Initiative (IPAR)

Digitalization and storage of farming data is an excellent tool available to producers, producer organizations, support organizations, and other partners. Protecting this data is nevertheless both a challenge and a requirement. The criminal use of personal data constitutes a real risk if special measures are not taken to ensure real anonymity of data. Identity abuse and the disclosure of personal data can expose the life of honest people, thereby having a negative impact on the rights and liberties of the people concerned.

Consequently, while it is crucial to have analytical data at one's disposal to be able to improve decision-making processes and performances, it is necessary to ensure that the collection, analysis, and dissemination of information comply with the minimum safety, traceability, and data anonymization standards.

OUTLOOK

The entry of rural populations into the digital economy is a strategic challenge for Senegal's development, bringing the promise of economic growth and inclusion. The important social capital represented by the interconnections forged between producers and self-managed information systems is a factor in promoting resilience to climate and economic shocks. Mastery of information technology and connectivity will create economic opportunities in terms of financial services, access to inputs, productive services, and marketing. It may also be used in universities and research institutes.

Feed the Future demonstrated that inclusive growth cannot be achieved without meaningfully integrating populations, and that young people are motivated to capture this opportunity. It is therefore important to avoid the development of "black box" solutions whereby producers are passive users. Instead, systems should be developed that facilitate access to their own data and thus develop their capacity for analysis and self-organizing.

It is in this perspective of integration that Feed the Future launched a digital platform to share network monitoring data with the Regional Rural Development Divisions (DRDR) of the Ministry of Agriculture and Rural Equipment. Up to this point, collaboration with government services had been tentative, but with practice farmers' organizations and other extension entities have succeeded in collecting reliable data that covers a significant part of the national territory. Thus, there is a good opportunity to make data available to the competent services of the Ministry of Agriculture and Rural Equipment and to reinforce the dialogue on an objective basis.

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TOWARDS INCLUSIVE ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS

The autonomous management of digital data acquired by producer groups will simplify their integration into future decentralized digital systems of their partners: input suppliers, banks, insurance companies, and industrial clients.

PHOTO

TO LEARN MORE

- Finding the best fit: Naatal Mbay case study, Cristina Manfre, USAID, Washington D.C., 2017
- Digital farmer profiles: reimagining smallholder agriculture, Grameen Foundation: Bobbi Gray & al., USAID/Bureau of Food Security and U.S. Global Development Lab, Washington DC, 2018
- Digital Development for Feed the Future (D2FTF), Digital Tools for Agriculture Website, USAID/Bureau of Food Security and U.S. Global Development Lab, Washington DC
- Farmer-owned cloud database environments improving the use of data in decision-making and value chain development through farmer managed data tracking and evaluation, USAID, 2015

This capitalization note note and the publications mentioned are available at the following address
www.usaid.gov/senegal
www.ipar.sn/chaines-de-valeur-agricoles-au-senegal

PHOTO
Agent taking a GPS reading in a rice growing area. Producers appreciate the precision of GPS which often reduces the cost of inputs and services calculated per hectare.

The Naatal Mbay project (Flourishing agriculture in Wolof), spanning four years (2015-2019), invested nearly US$ 24 million (12 billion CFA francs) to support the rice, maize, and millet cereal value chains. It has created business opportunities for inclusive growth and development of the agricultural sector in the Delta and the Senegal River Valley, in the southern portion of the central peanut basin, and in the southern regions of Ziguinchor, Sédhiou, and Kolda. Naatal Mbay was implemented in the context of Feed the Future, an initiative launched by the Government of the United States of America in 2011 to combat hunger and food insecurity in the world.

For more information :
www.feedthefuture.gov

USAID is the United States Agency for International Development, one of the most active agencies in the world in this field. In Senegal, USAID is working in close collaboration with the Government of Senegal in the fields of health, economic growth, agriculture, education, and good governance.

For more information :
www.usaid.gov/senegal

The Agricultural and Rural Prospective Initiative (IPAR) is a space for reflection, dialogue, and coordinated agricultural and rural policy proposals in Senegal and in the West African region. IPAR's main research topics are: (i) structural transformation of agriculture; (ii) climate change; (iii) migration and youth employment; (iv) sustainable development objectives; and (v) governance of natural and land resources

For more information :
www.ipar.sn